US006408068B1

(12) **United States Patent**
**Larson et al.**

(10) **Patent No.: US 6,408,068 B1**
(45) **Date of Patent: Jun. 18, 2002**

(54) **MODULAR TELEPHONE**

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(73) Assignee: **Kool! Technologies, Inc.**, St. Paul, MN (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/183,435**

(22) Filed: **Oct. 30, 1998**

(51) **Int. Cl.**[7] ..... **H04M 11/00**; H04M 11/02

(52) **U.S. Cl.** ..... **379/357.01**; 379/356.01; 379/357.02; 379/357.05; 379/353; 379/434; 379/93.05

(58) **Field of Search** ..... 379/351–361, 379/93.06, 282, 434; 455/331, 90

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(List continued on next page.)

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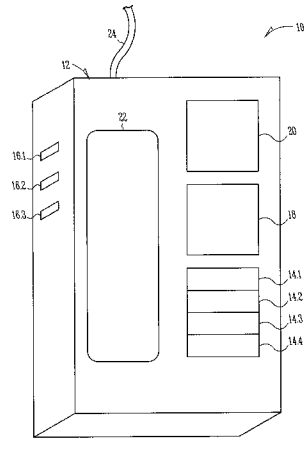
*Assistant Examiner*—Ramnandan Singh
(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg, Woessner & Kluth, P.A.

(57) **ABSTRACT**

An electronic system such as a modular telephone which includes one or more module slots used to add features. The module slots are configured to receive modules adding the software and hardware necessary to provide the desired features.

**15 Claims, 37 Drawing Sheets**



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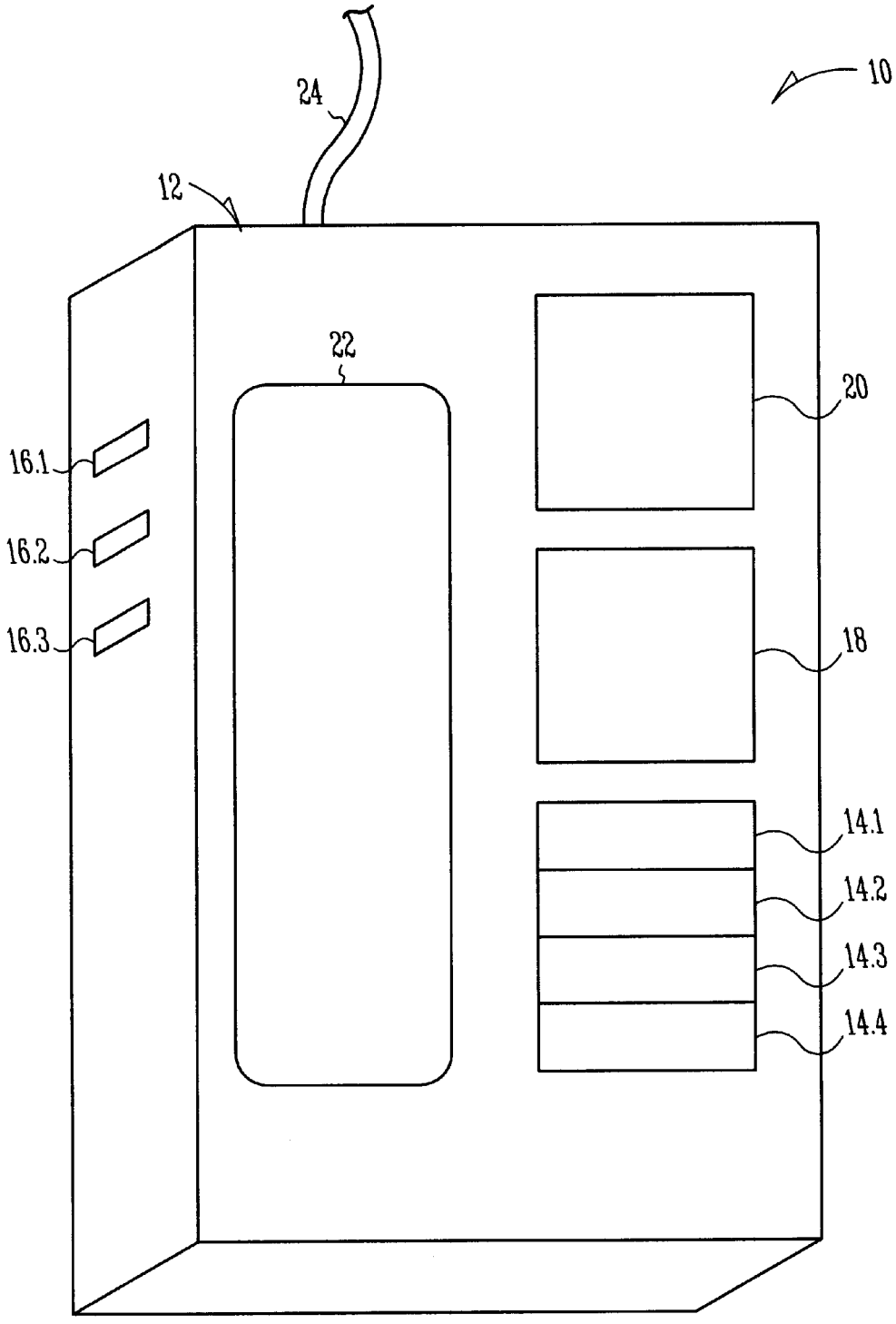



Fig.1

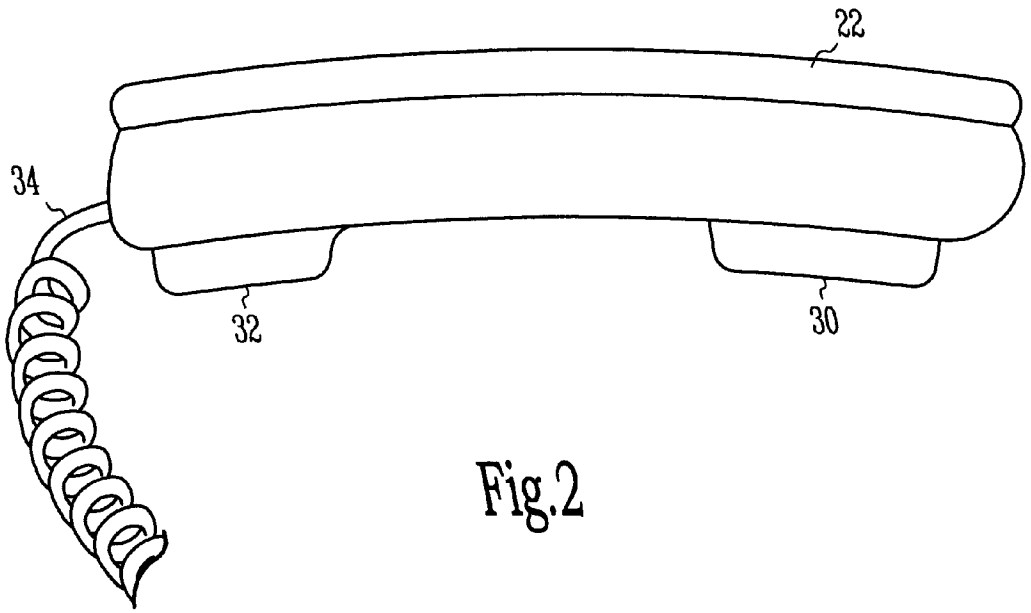
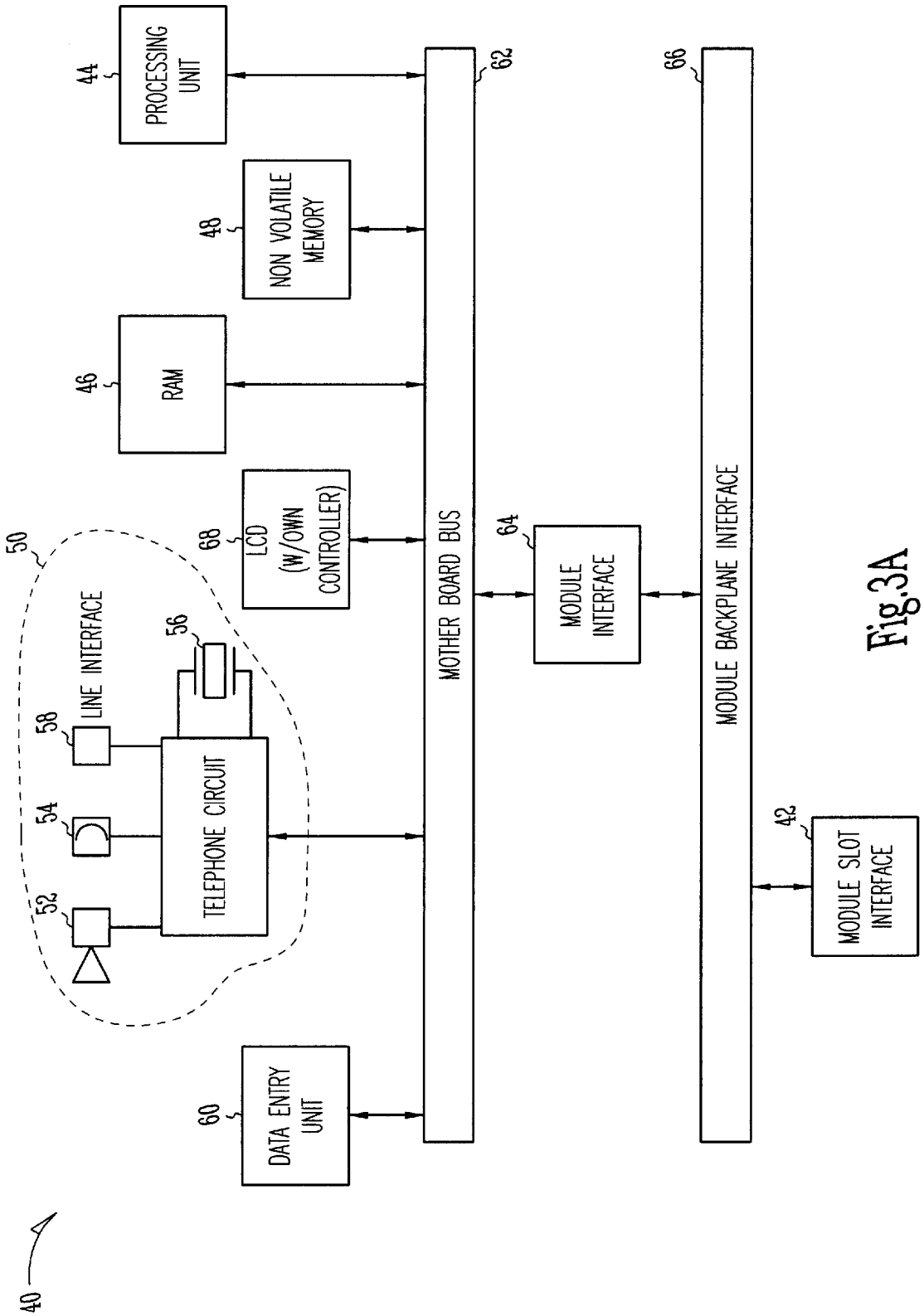



Fig.2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50
52
54
56
58
LINE INTERFACE
TELEPHONE CIRCUIT
44
PROCESSING UNIT
48
NON VOLATILE MEMORY
46
RAM
68
LCD (W/OWN CONTROLLER)
60
DATA ENTRY UNIT
62
MOTHER BOARD BUS
64
MODULE INTERFACE
66
MODULE BACKPLANE INTERFACE
42
MODULE SLOT INTERFACE

Fig.3A

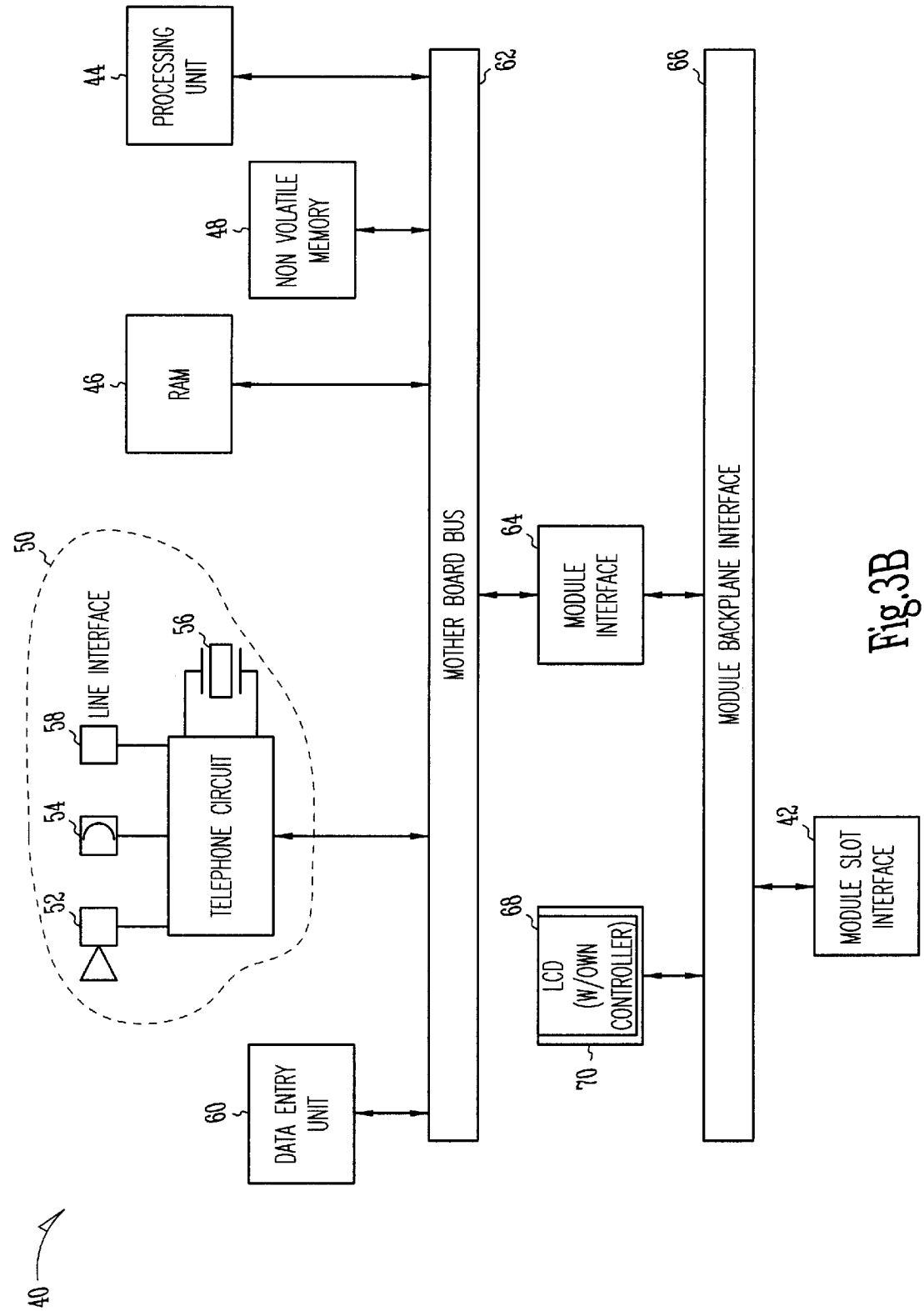
40
44
PROCESSING UNIT
48
NON VOLATILE MEMORY
46
RAM
62
MOTHER BOARD BUS
66
MODULE BACKPLANE INTERFACE
64
MODULE INTERFACE
50
LINE INTERFACE
56
58
54
52
TELEPHONE CIRCUIT
60
DATA ENTRY UNIT
68
LCD (W/OWN CONTROLLER)
70
42
MODULE SLOT INTERFACE

Fig.3B

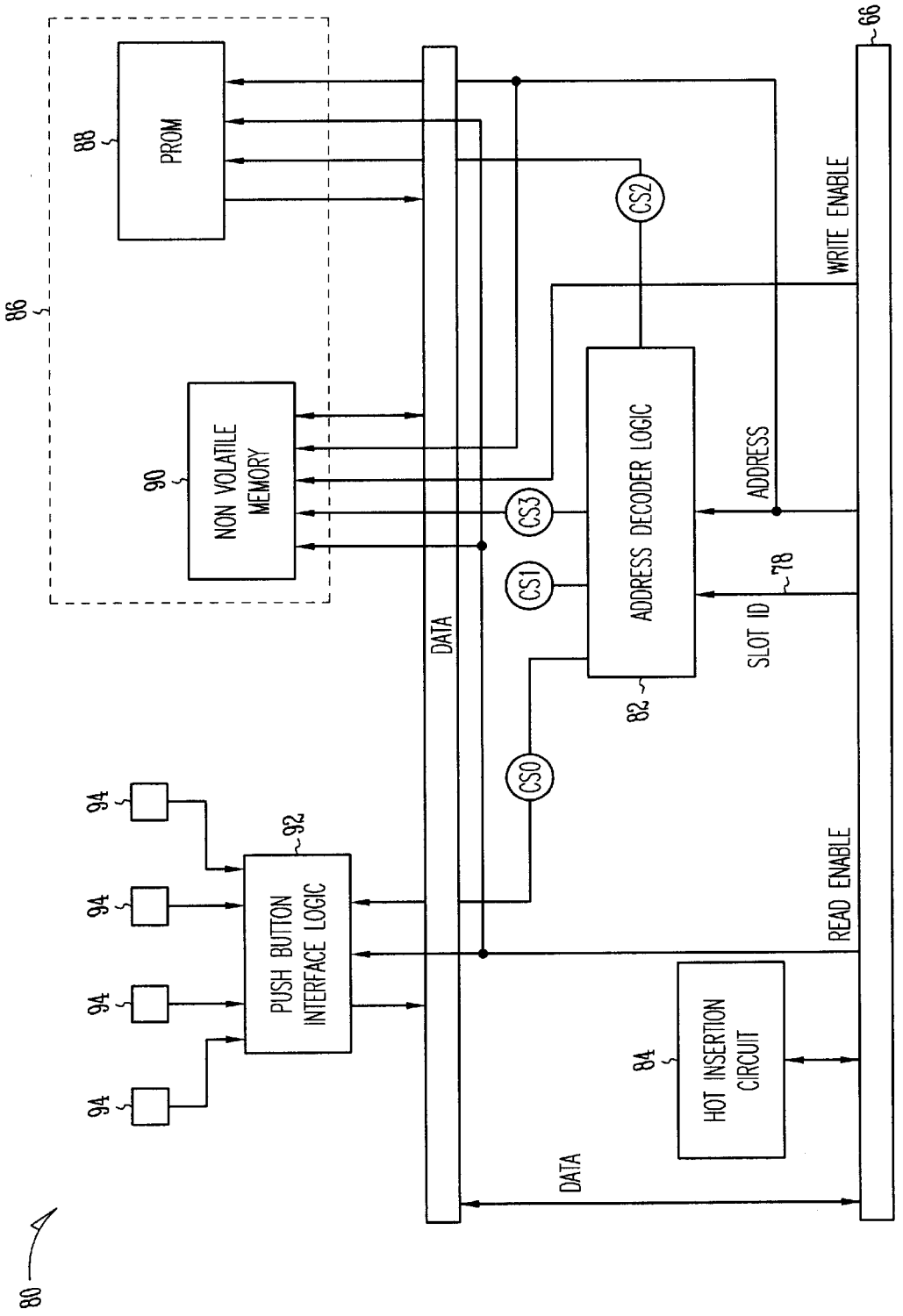
80
86
88
PROM
90
NON VOLATILE MEMORY
66
WRITE ENABLE
READ ENABLE
DATA
ADDRESS
SLOT ID
78
82
ADDRESS DECODER LOGIC
CS0
CS1
CS2
CS3
84
HOT INSERTION CIRCUIT
92
PUSH BUTTON INTERFACE LOGIC
94

Fig.4A

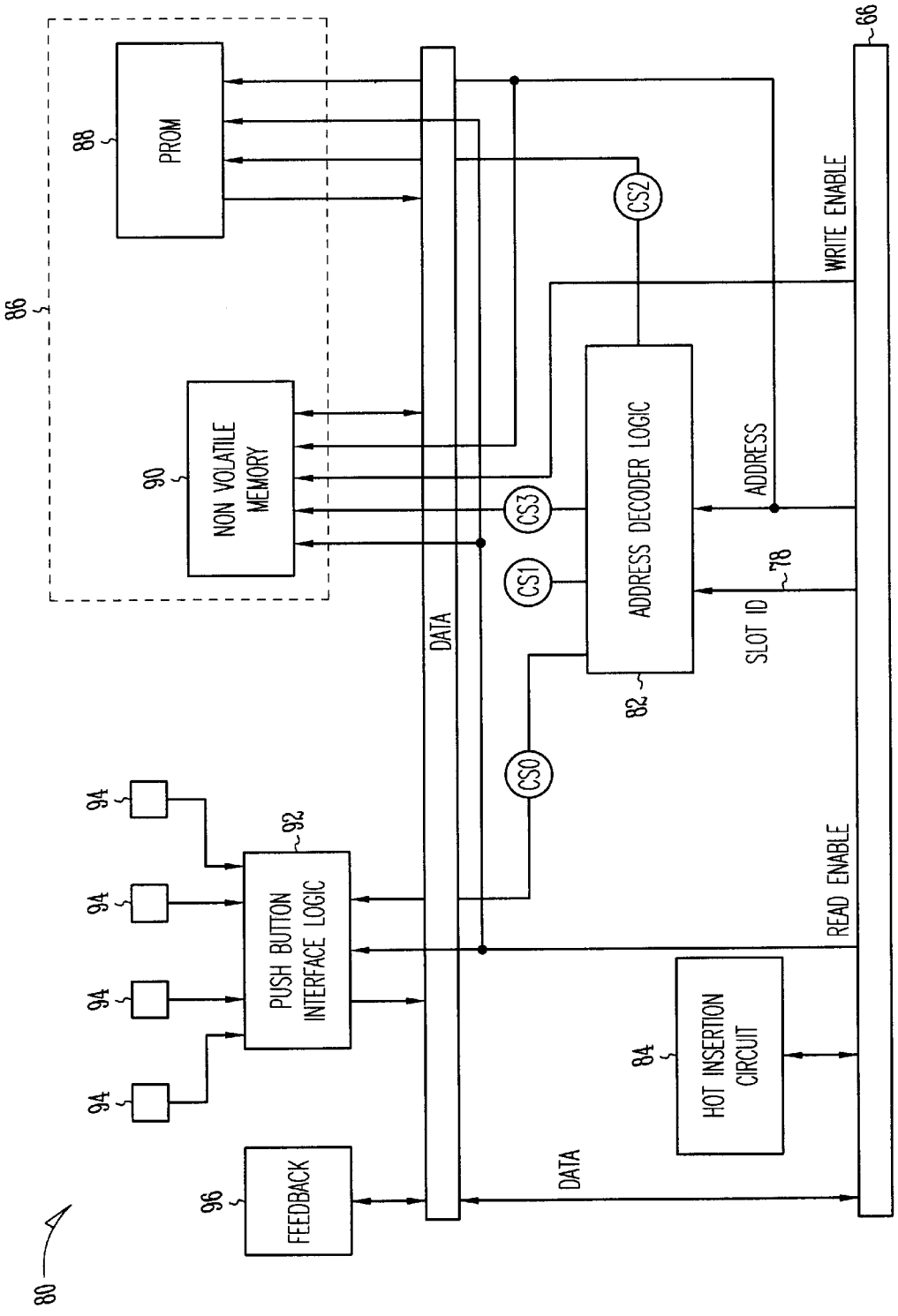
80
86
88
PROM
90
NON VOLATILE MEMORY
94
92
PUSH BUTTON INTERFACE LOGIC
96
FEEDBACK
DATA
CS0
CS1
CS2
CS3
82
ADDRESS DECODER LOGIC
ADDRESS
SLOT ID
78
WRITE ENABLE
READ ENABLE
66
84
HOT INSERTION CIRCUIT
DATA

Fig.4B

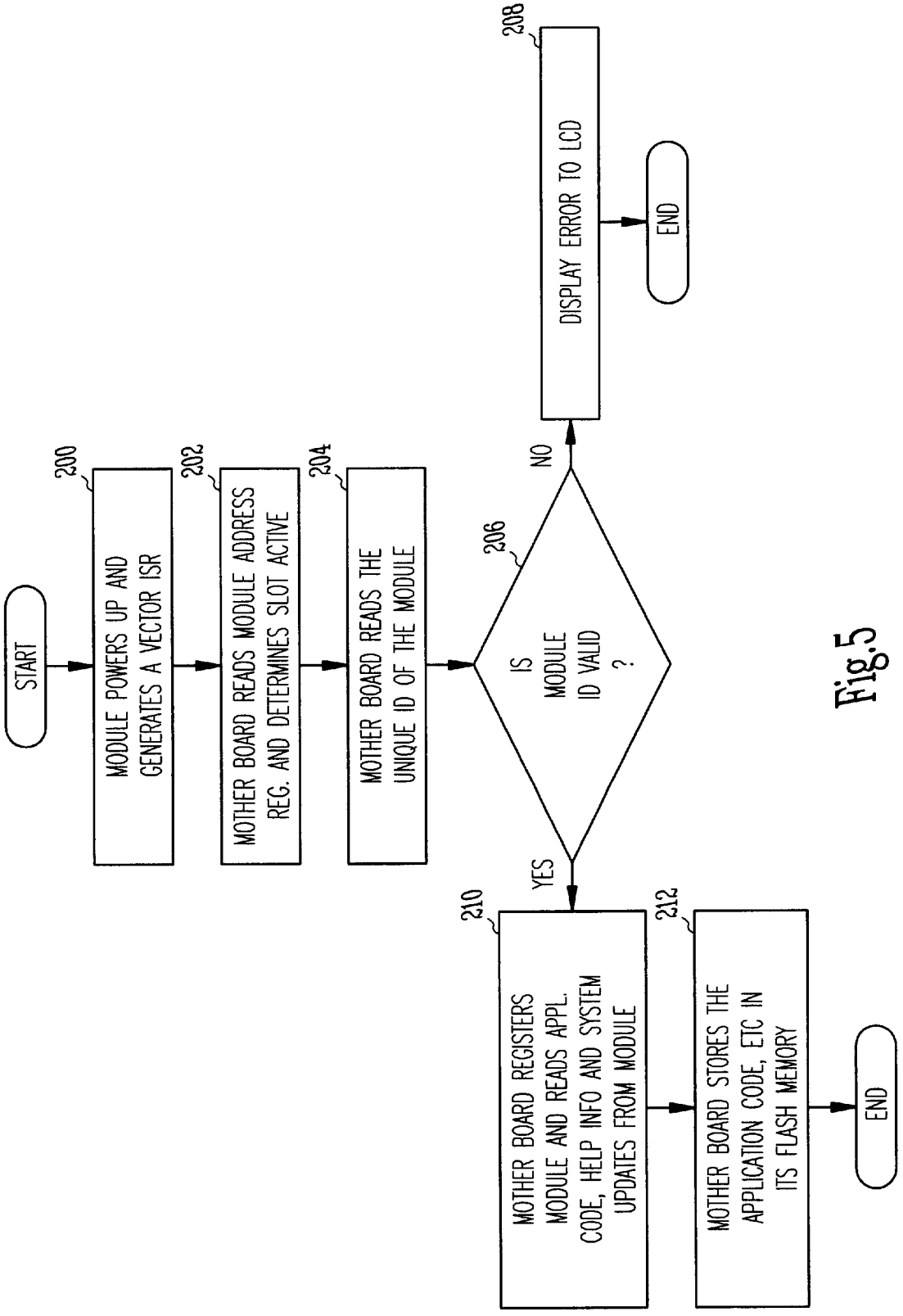
START
200
MODULE POWERS UP AND GENERATES A VECTOR ISR
202
MOTHER BOARD READS MODULE ADDRESS REG. AND DETERMINES SLOT ACTIVE
204
MOTHER BOARD READS THE UNIQUE ID OF THE MODULE
206
IS MODULE ID VALID ?
NO
208
DISPLAY ERROR TO LCD
END
YES
210
MOTHER BOARD REGISTERS MODULE AND READS APPL. CODE, HELP INFO AND SYSTEM UPDATES FROM MODULE
212
MOTHER BOARD STORES THE APPLICATION CODE, ETC IN ITS FLASH MEMORY
END

Fig.5

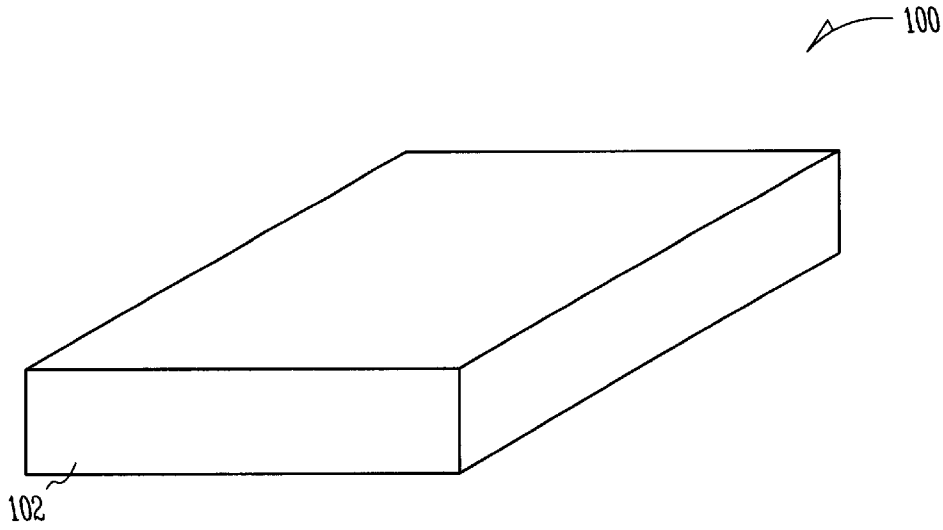


Fig.6A

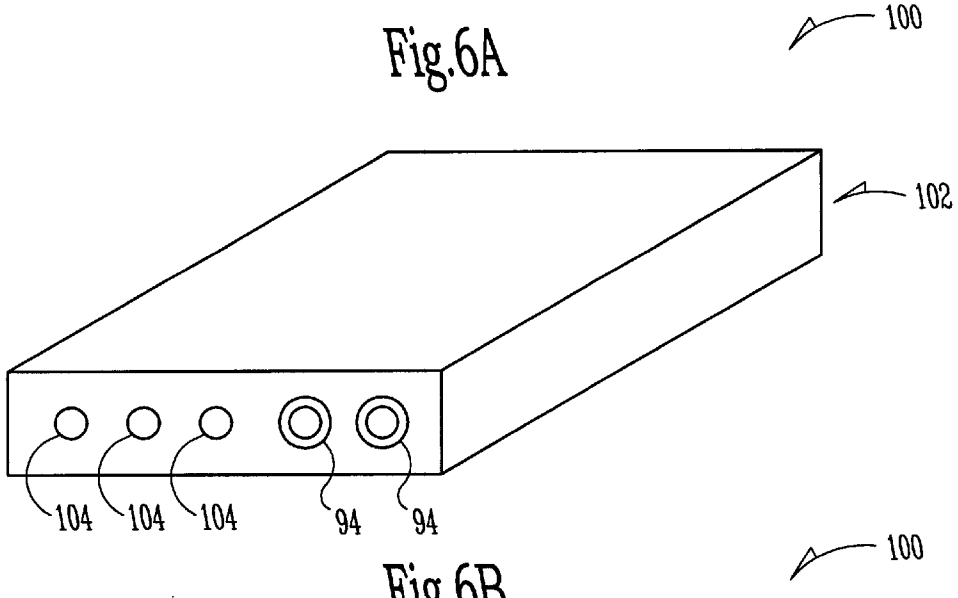


Fig.6B

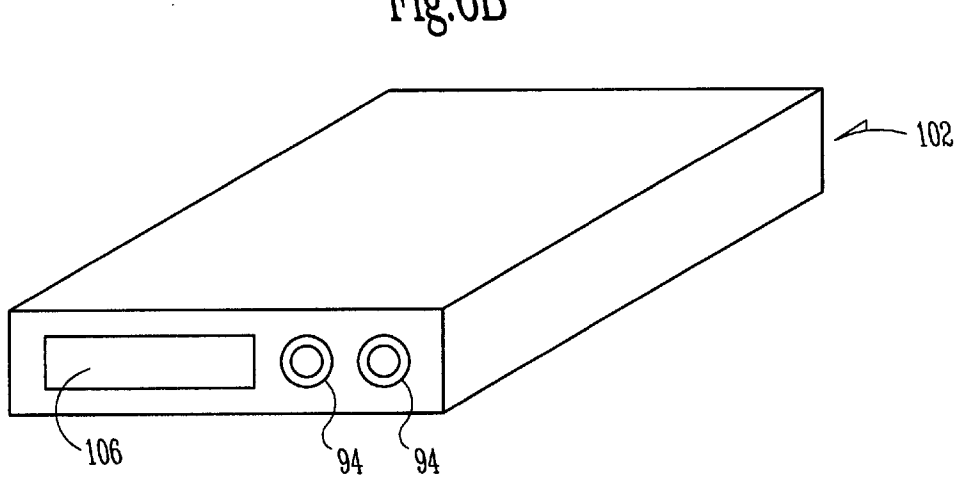


Fig.6C

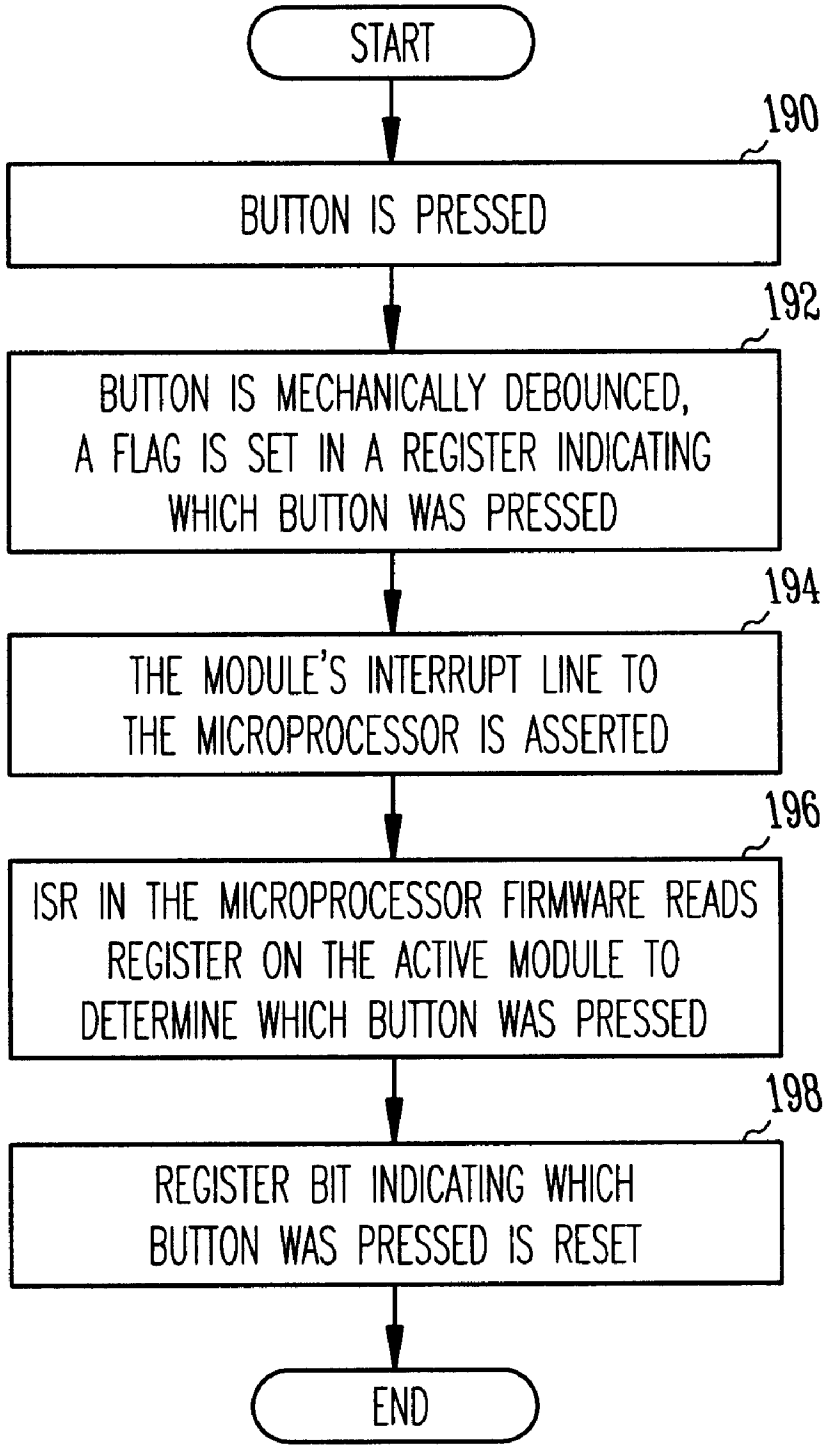
START
190
BUTTON IS PRESSED
192
BUTTON IS MECHANICALLY DEBOUNCED, A FLAG IS SET IN A REGISTER INDICATING WHICH BUTTON WAS PRESSED
194
THE MODULE'S INTERRUPT LINE TO THE MICROPROCESSOR IS ASSERTED
196
ISR IN THE MICROPROCESSOR FIRMWARE READS REGISTER ON THE ACTIVE MODULE TO DETERMINE WHICH BUTTON WAS PRESSED
198
REGISTER BIT INDICATING WHICH BUTTON WAS PRESSED IS RESET
END

Fig.7

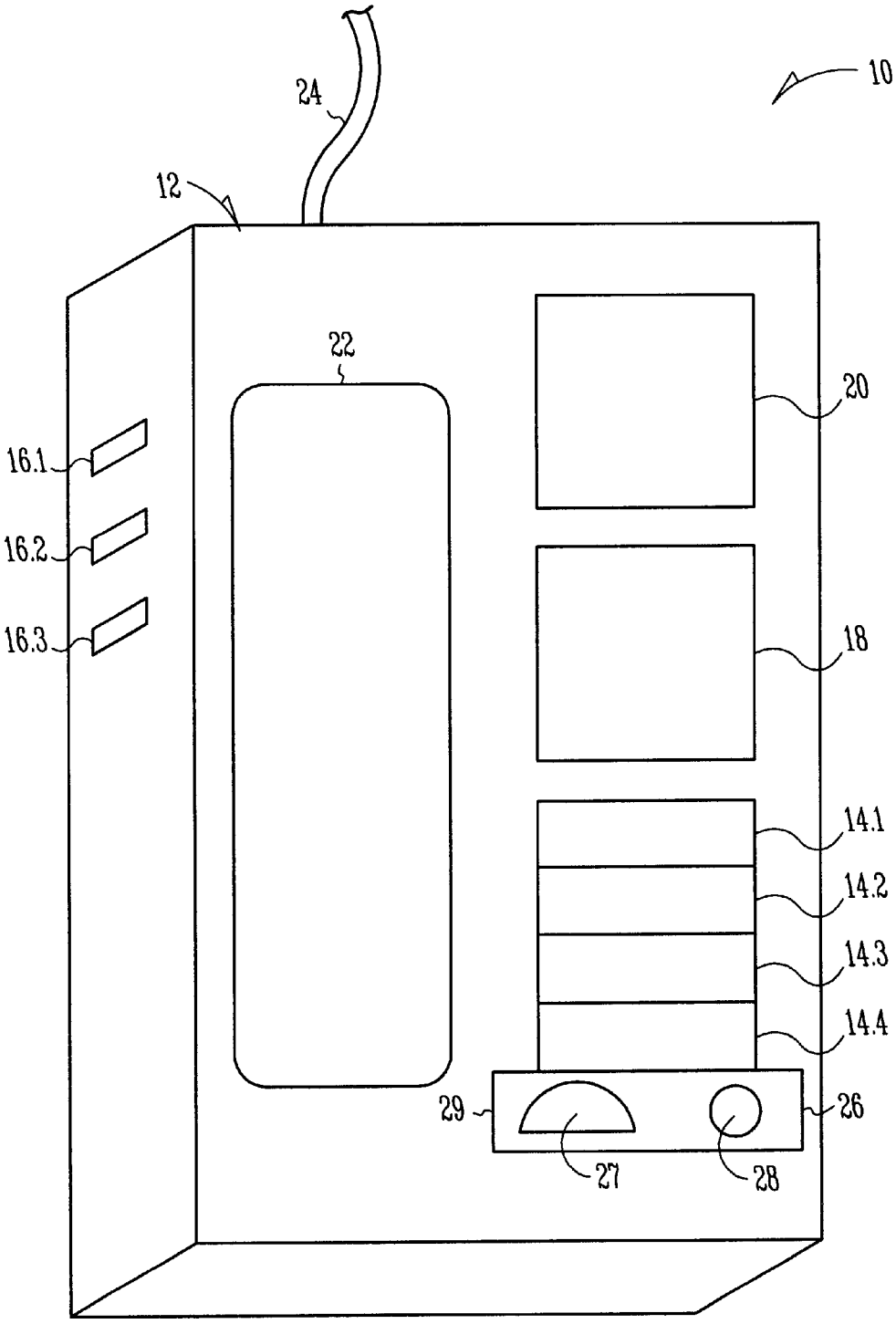


Fig.8

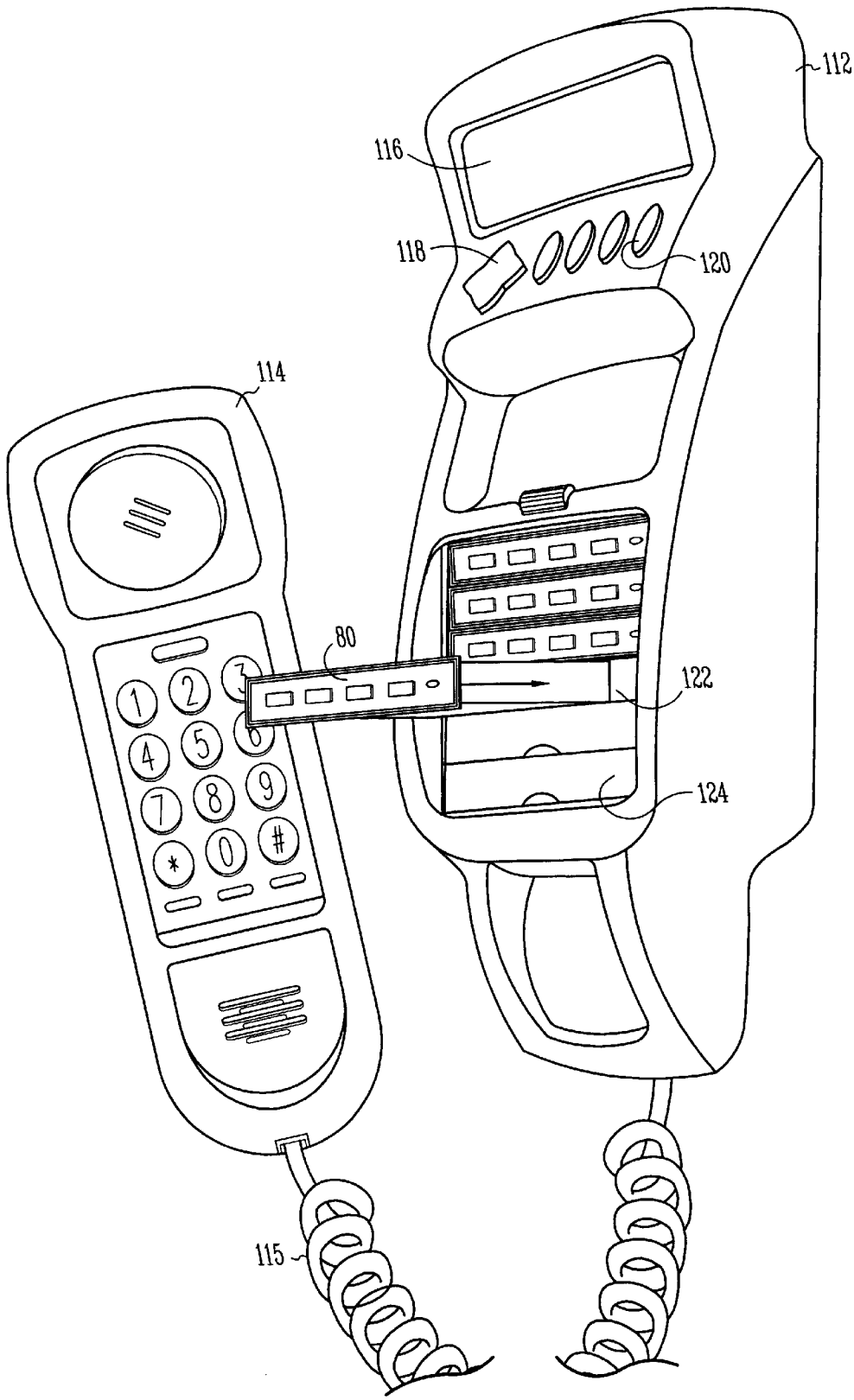


Fig.9A

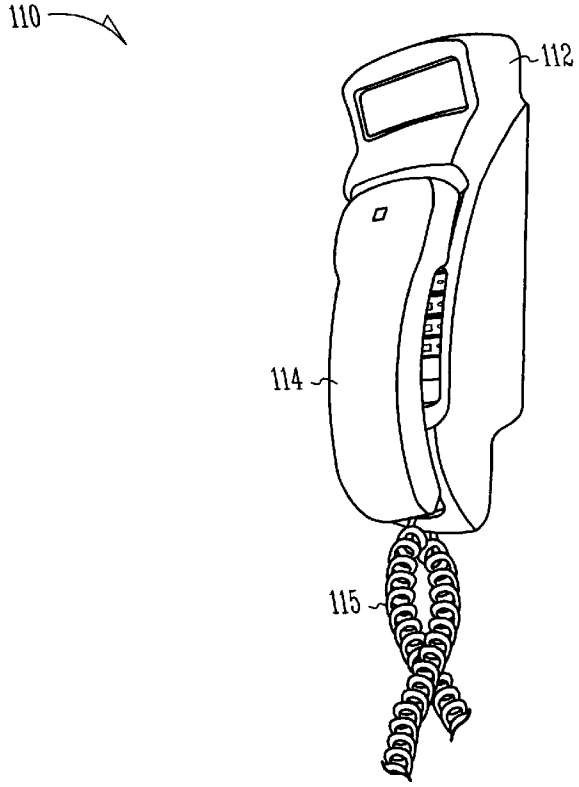
110
112
114
115

Fig.9B

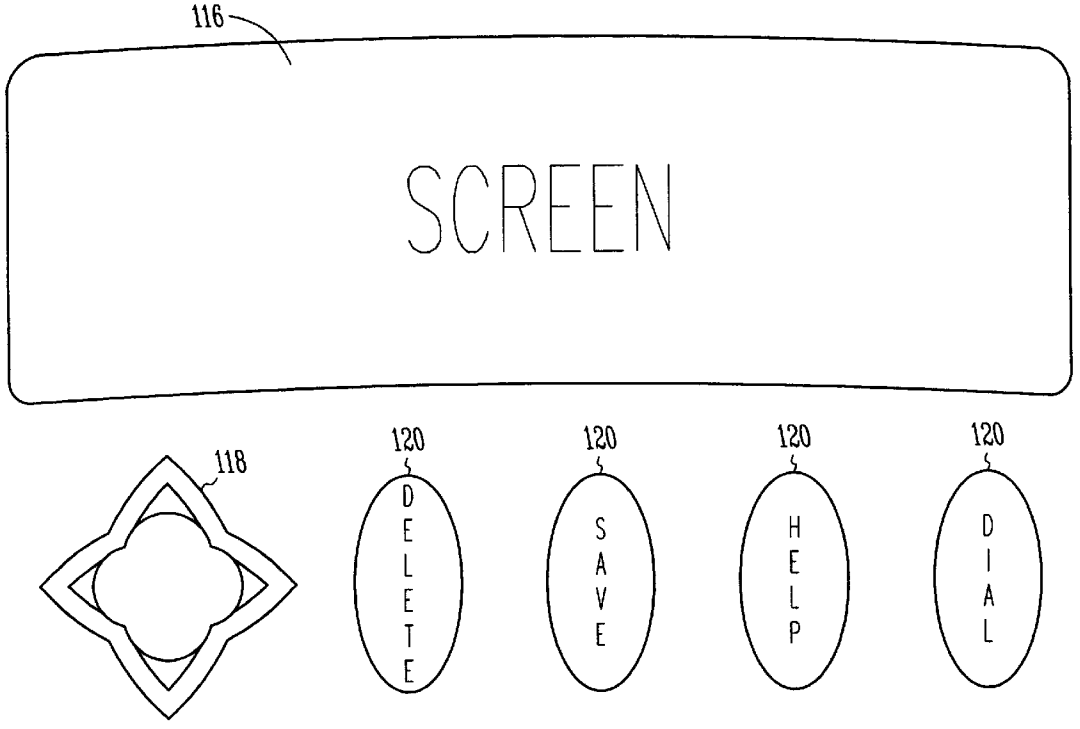
116
SCREEN
118
120
DELETE
120
SAVE
120
HELP
120
DIAL

Fig.9C

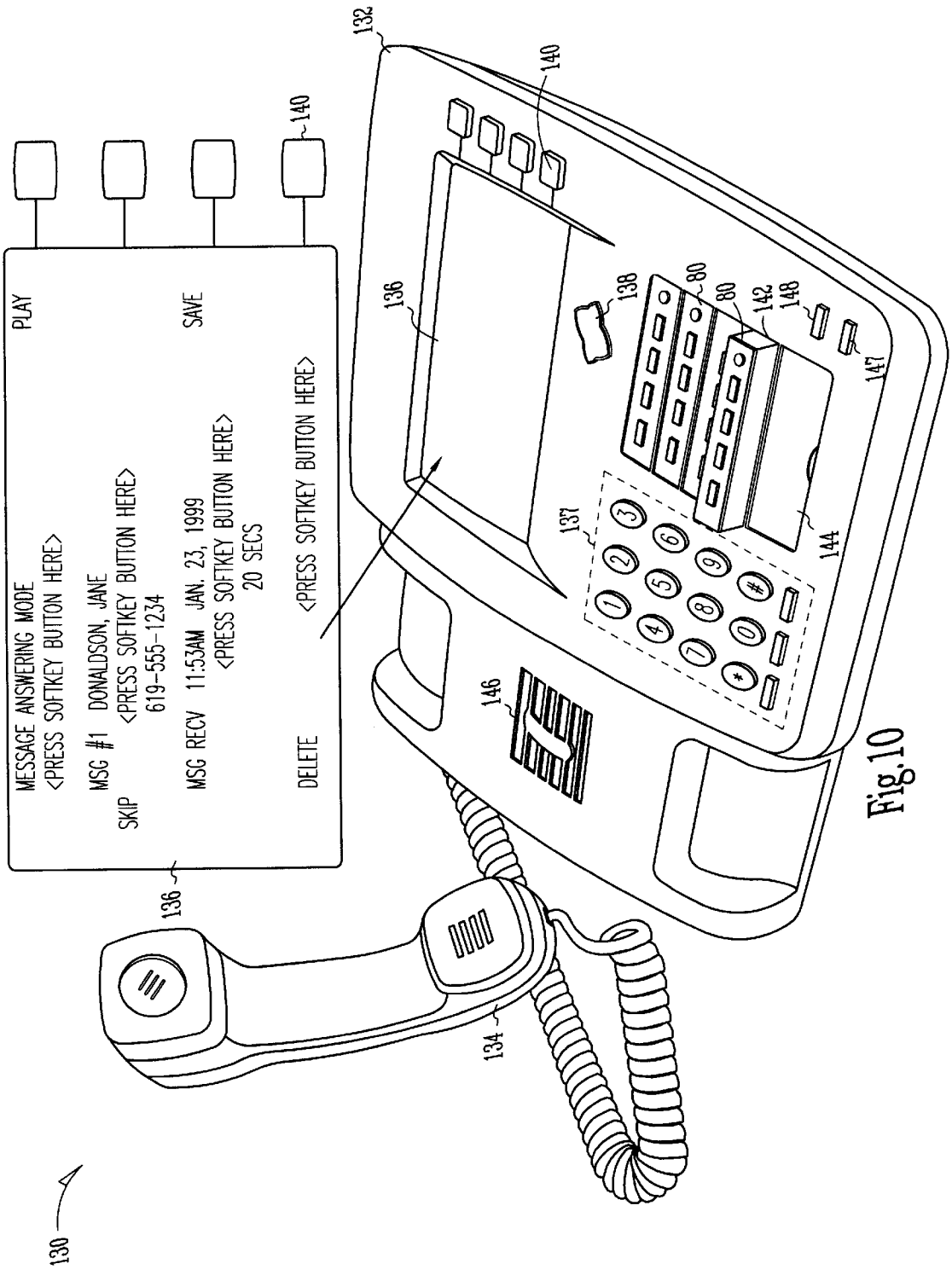
MESSAGE ANSWERING MODE
<PRESS SOFTKEY BUTTON HERE>
MSG #1 DONALDSON, JANE
SKIP <PRESS SOFTKEY BUTTON HERE>
619-555-1234
MSG RECV 11:53AM JAN. 23, 1999
<PRESS SOFTKEY BUTTON HERE>
20 SECS
DELETE <PRESS SOFTKEY BUTTON HERE>
PLAY
SAVE
130
132
134
136
137
138
140
142
144
146
147
148

Fig.10

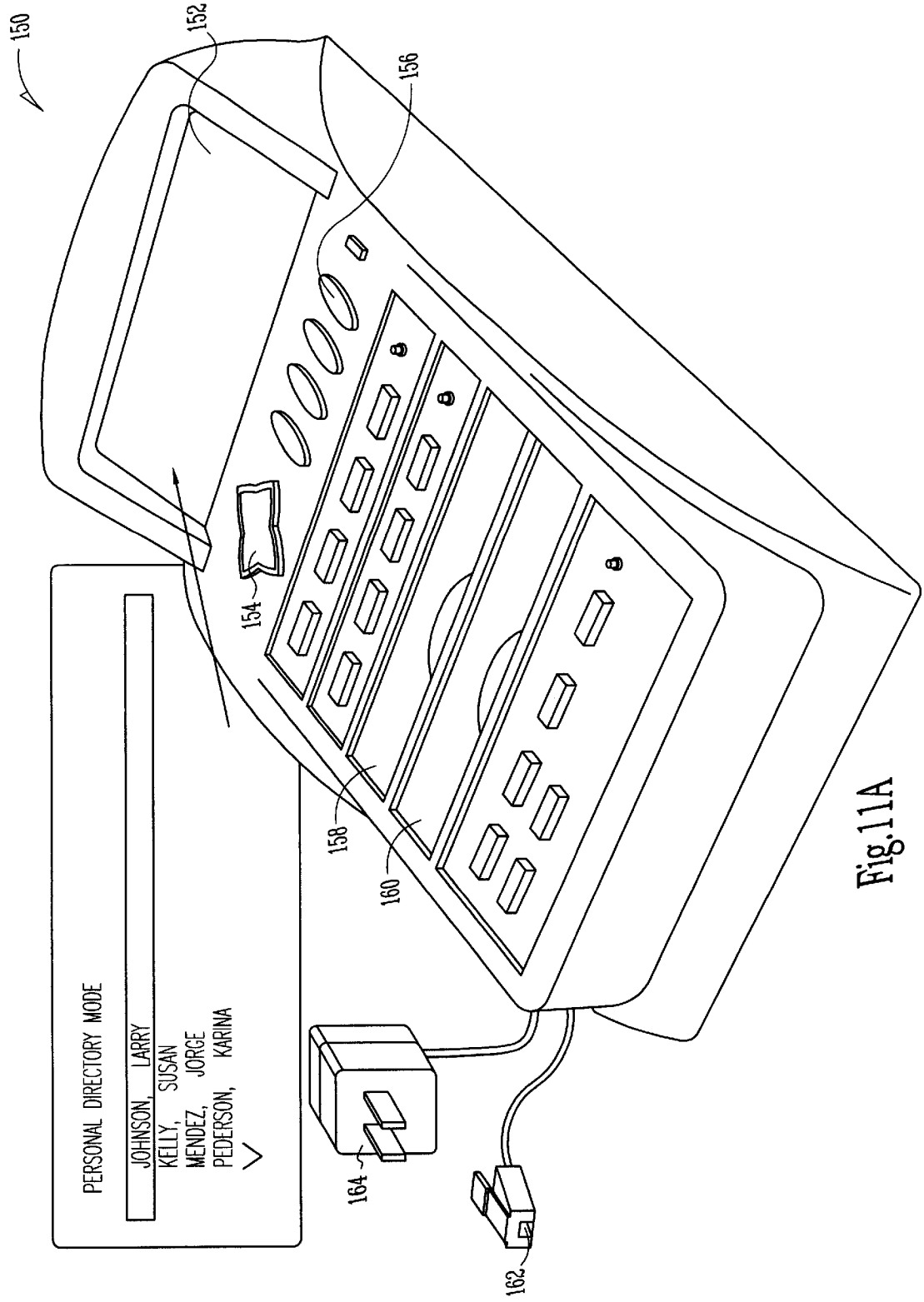
150
152
156
154
158
160
164
162
PERSONAL DIRECTORY MODE
JOHNSON, LARRY
KELLY, SUSAN
MENDEZ, JORGE
PEDERSON, KARINA

Fig.11A

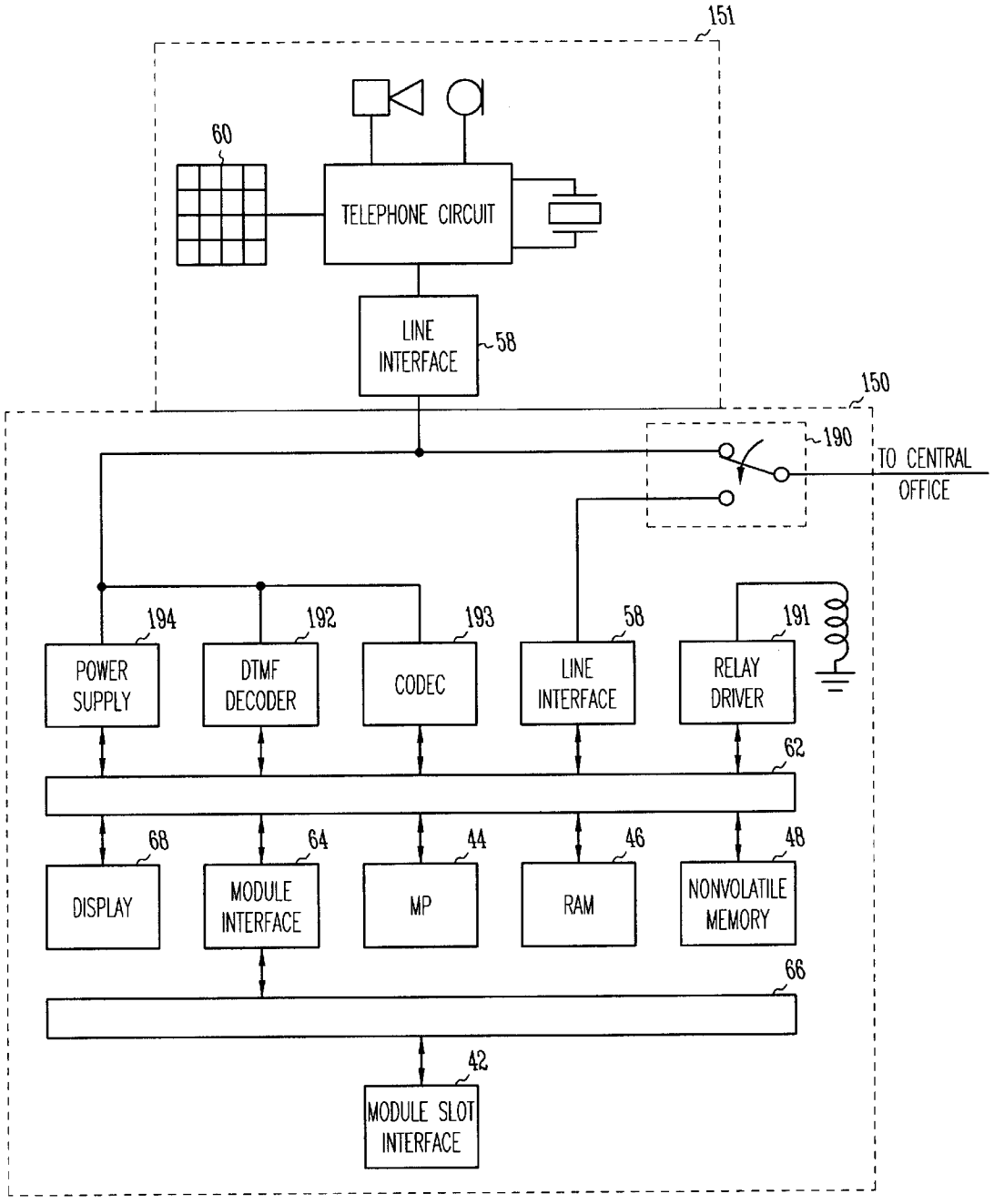
151
60
TELEPHONE CIRCUIT
LINE INTERFACE
58
150
190
TO CENTRAL OFFICE
194
POWER SUPPLY
192
DTMF DECODER
193
CODEC
58
LINE INTERFACE
191
RELAY DRIVER
62
68
DISPLAY
64
MODULE INTERFACE
44
MP
46
RAM
48
NONVOLATILE MEMORY
66
42
MODULE SLOT INTERFACE

Fig.11B

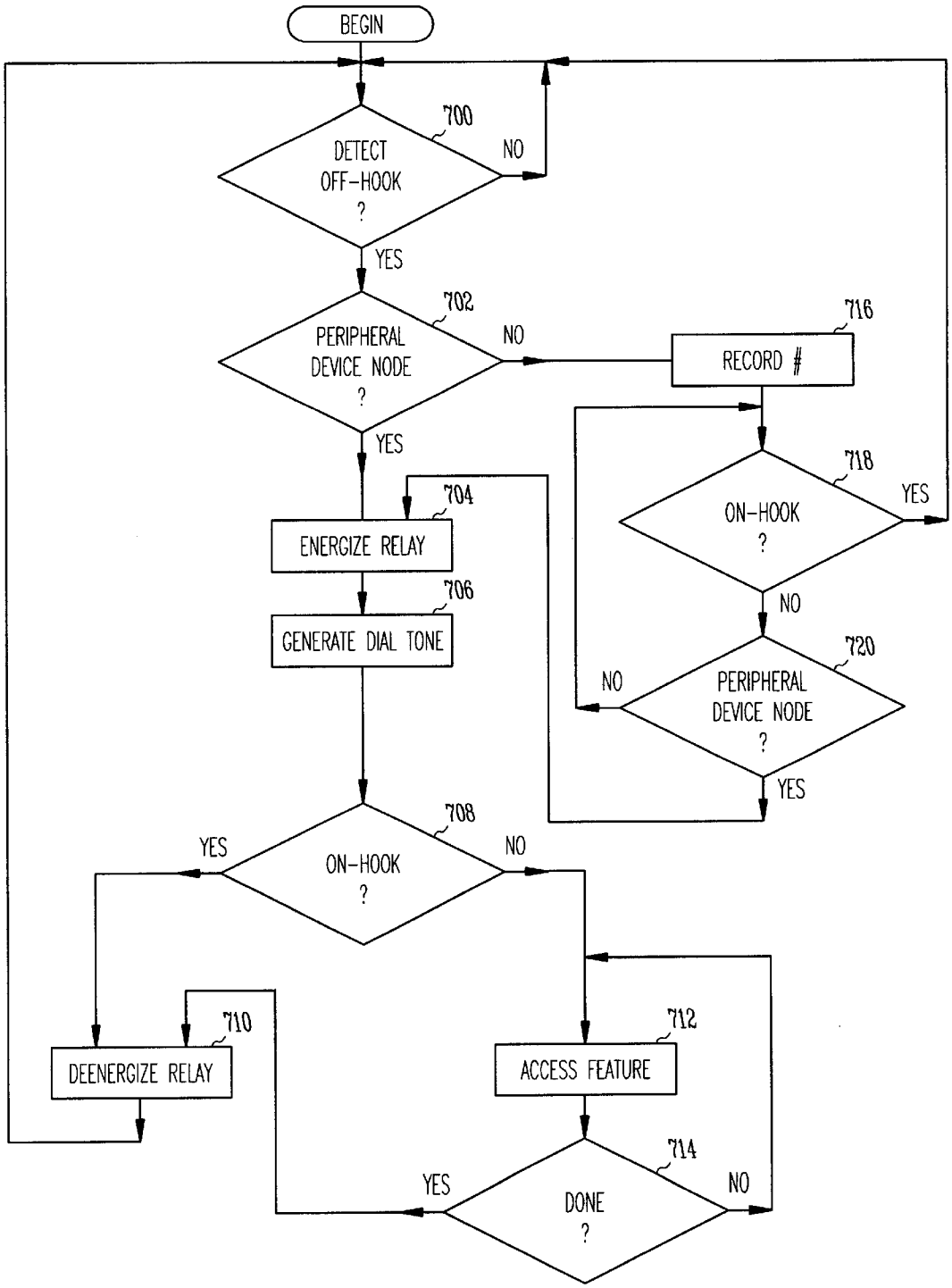
BEGIN
700
DETECT OFF-HOOK ?
NO
YES
702
PERIPHERAL DEVICE NODE ?
NO
716
RECORD #
YES
704
ENERGIZE RELAY
706
GENERATE DIAL TONE
718
ON-HOOK ?
YES
NO
720
PERIPHERAL DEVICE NODE ?
NO
YES
708
ON-HOOK ?
YES
NO
710
DEENERGIZE RELAY
712
ACCESS FEATURE
714
DONE ?
YES
NO

Fig.11C

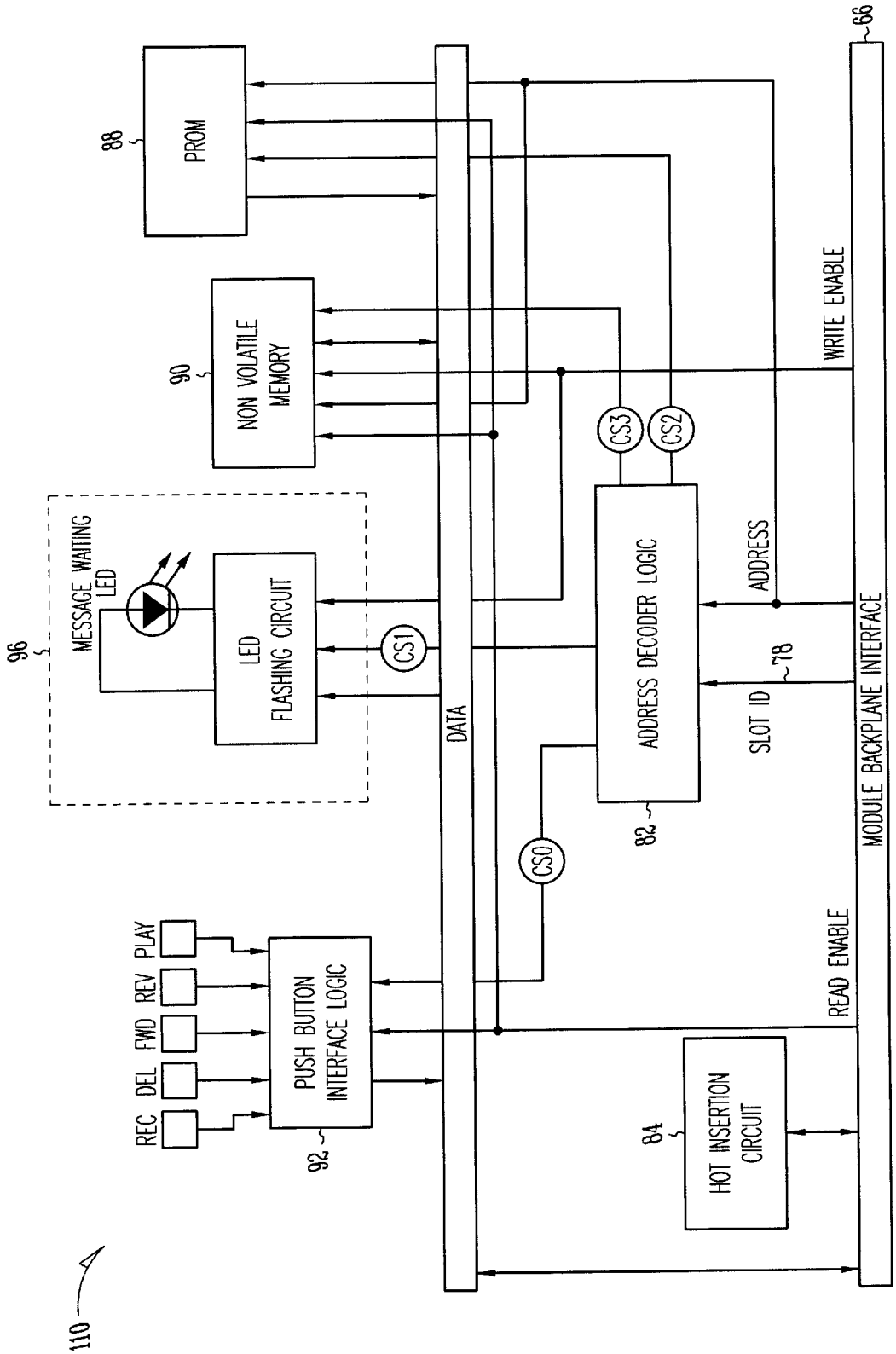
110
96
MESSAGE WAITING LED
LED FLASHING CIRCUIT
CS1
88
PROM
90
NON VOLATILE MEMORY
CS3
CS2
ADDRESS DECODER LOGIC
82
CS0
DATA
ADDRESS
SLOT ID
78
WRITE ENABLE
READ ENABLE
66
MODULE BACKPLANE INTERFACE
REC DEL FWD REV PLAY
PUSH BUTTON INTERFACE LOGIC
92
84
HOT INSERTION CIRCUIT

Fig.12

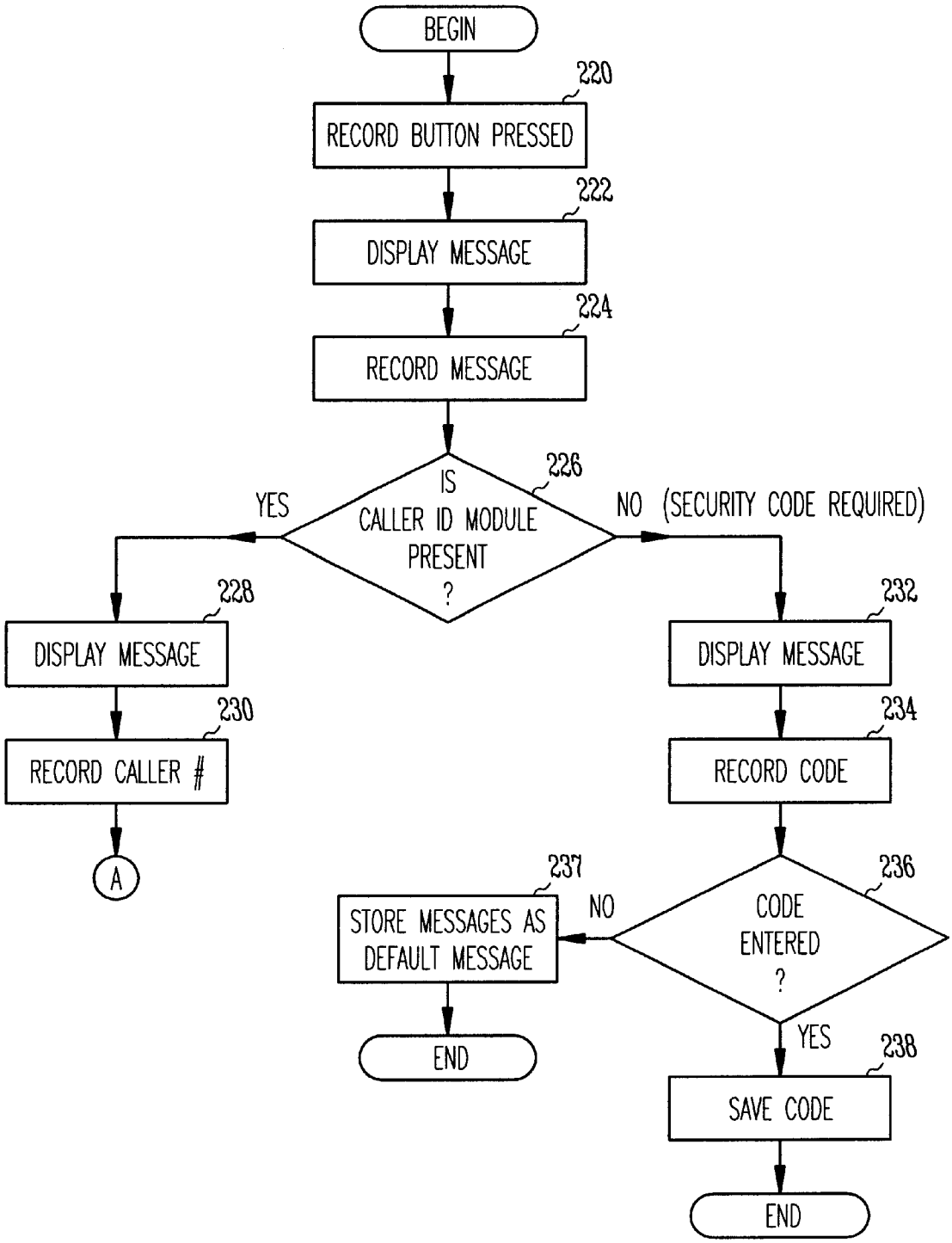
BEGIN
220
RECORD BUTTON PRESSED
222
DISPLAY MESSAGE
224
RECORD MESSAGE
226
IS CALLER ID MODULE PRESENT ?
YES
NO (SECURITY CODE REQUIRED)
228
DISPLAY MESSAGE
230
RECORD CALLER #
A
232
DISPLAY MESSAGE
234
RECORD CODE
236
CODE ENTERED ?
NO
237
STORE MESSAGES AS DEFAULT MESSAGE
END
YES
238
SAVE CODE
END

Fig.13A

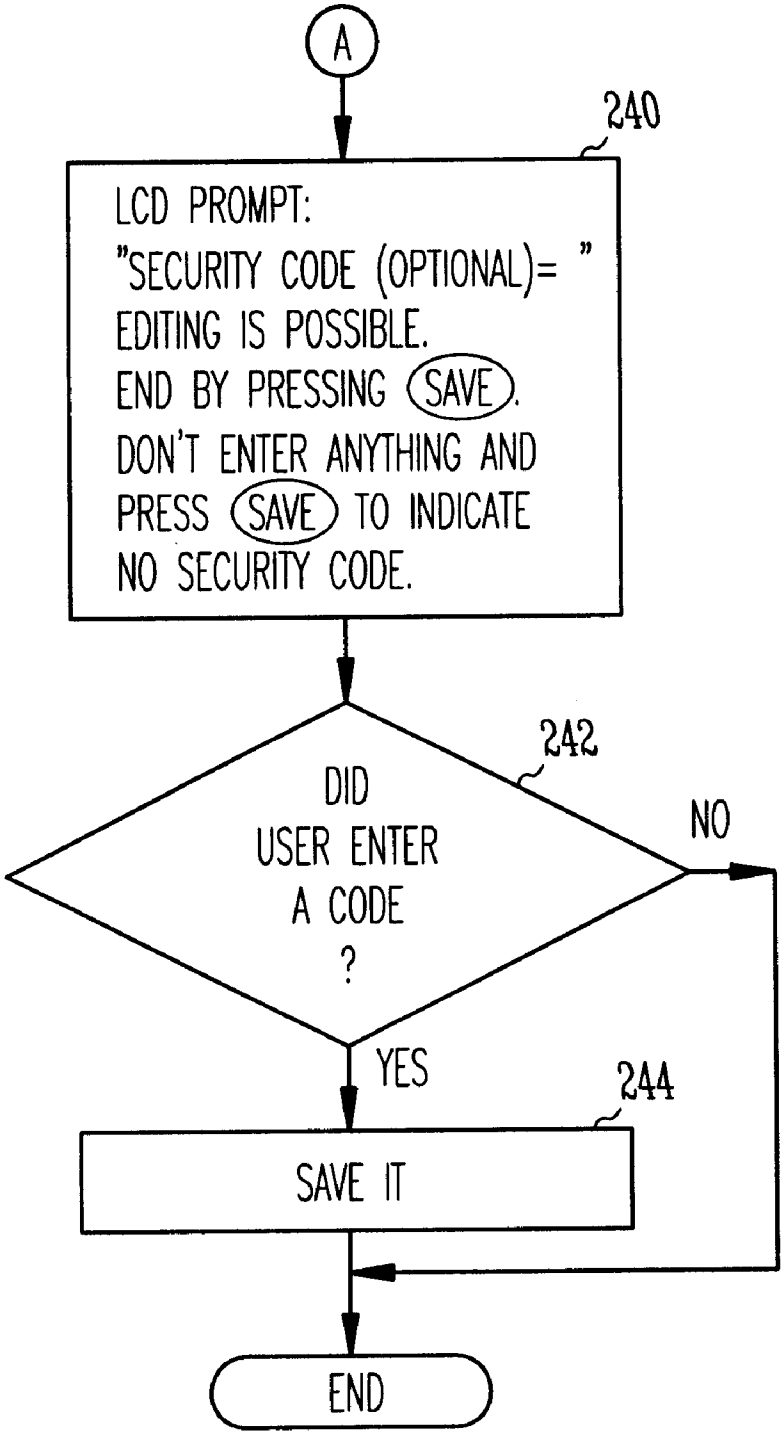
A
240
LCD PROMPT:
"SECURITY CODE (OPTIONAL)= "
EDITING IS POSSIBLE.
END BY PRESSING SAVE.
DON'T ENTER ANYTHING AND
PRESS SAVE TO INDICATE
NO SECURITY CODE.
242
DID
USER ENTER
A CODE
?
NO
YES
244
SAVE IT
END

Fig.13B

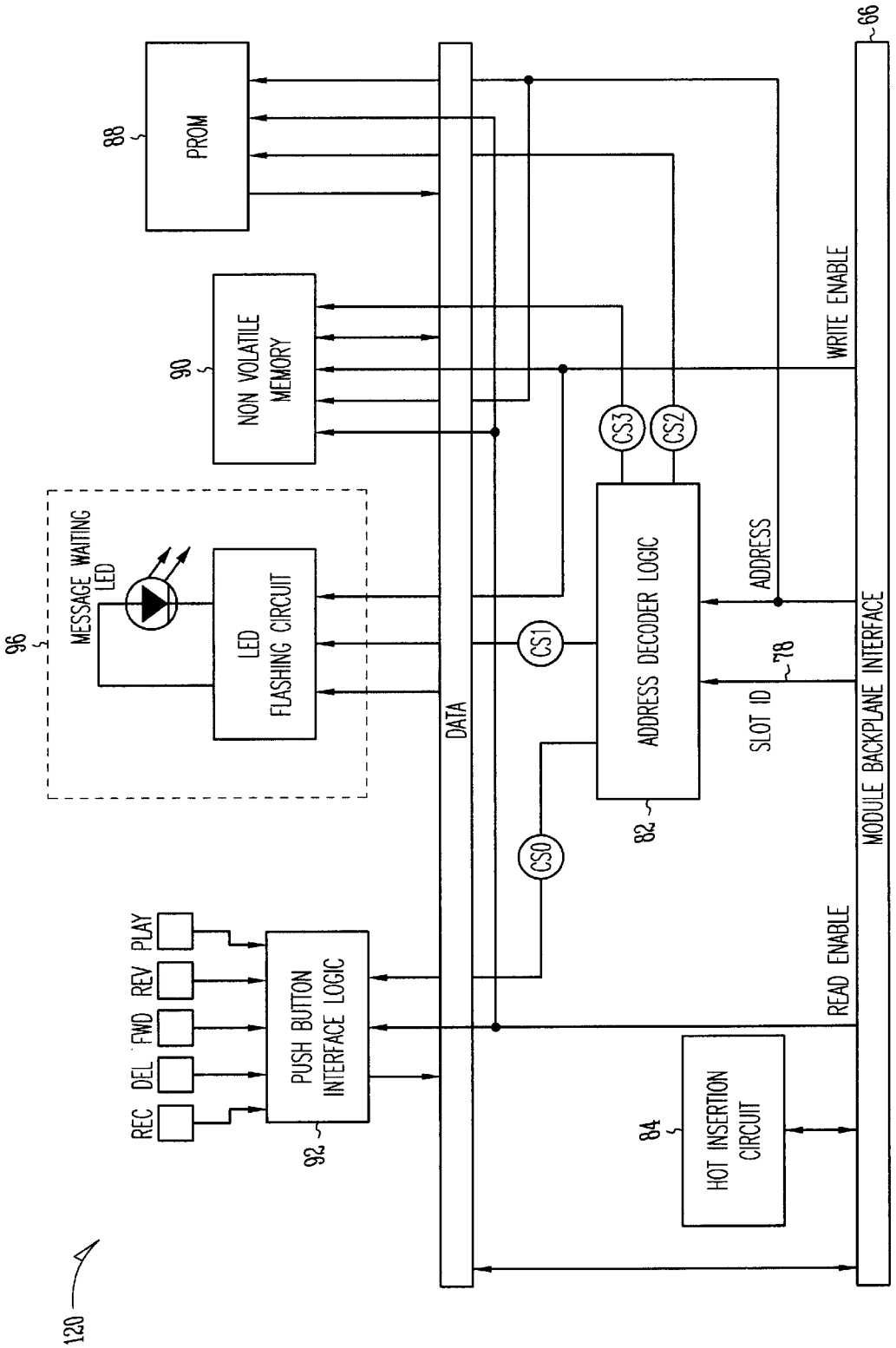
120
66
88
PROM
90
NON VOLATILE MEMORY
96
MESSAGE WAITING LED
LED FLASHING CIRCUIT
DATA
CS3
CS2
CS1
CS0
ADDRESS DECODER LOGIC
82
ADDRESS
WRITE ENABLE
78
SLOT ID
MODULE BACKPLANE INTERFACE
READ ENABLE
REC
DEL
FWD
REV
PLAY
PUSH BUTTON INTERFACE LOGIC
92
84
HOT INSERTION CIRCUIT

Fig.14

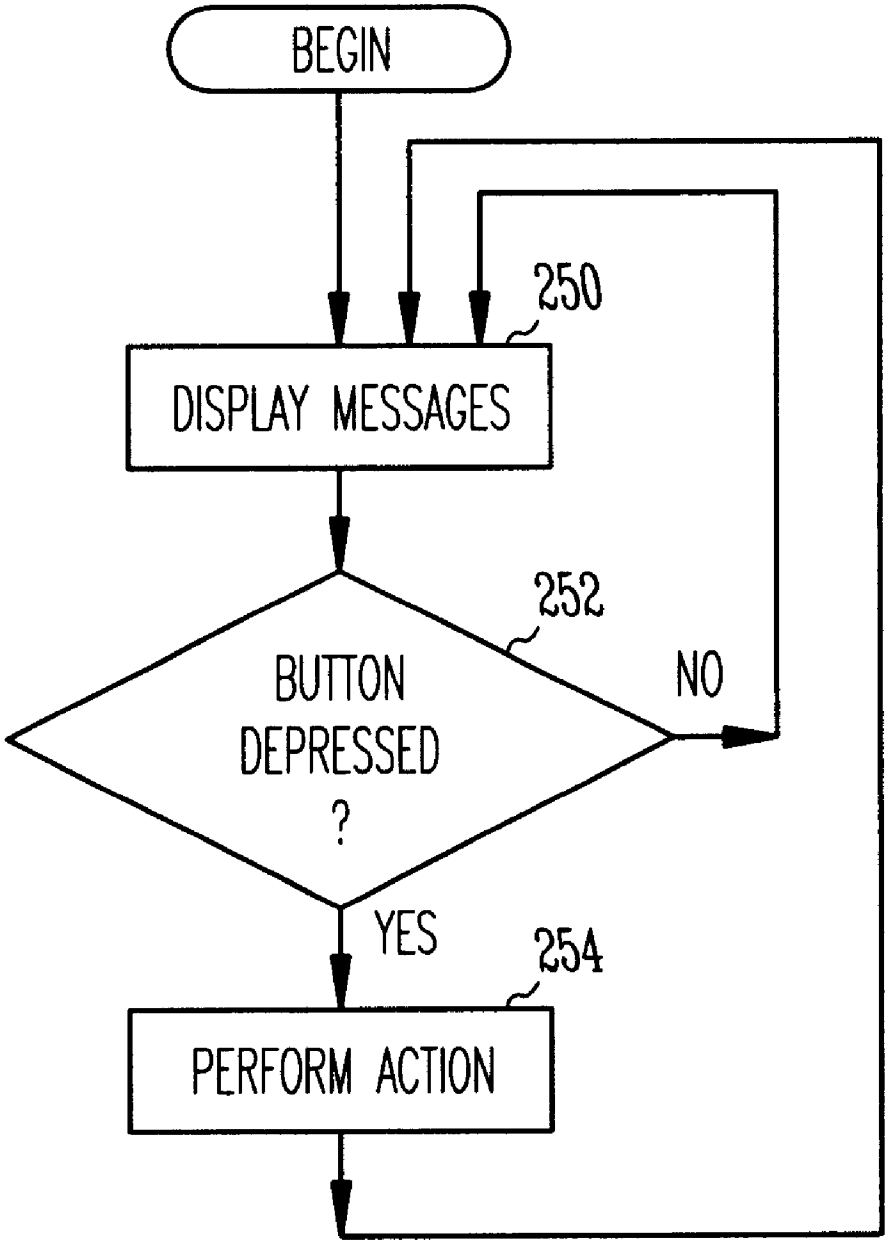
BEGIN
250
DISPLAY MESSAGES
252
BUTTON DEPRESSED ?
NO
YES
254
PERFORM ACTION

Fig.15

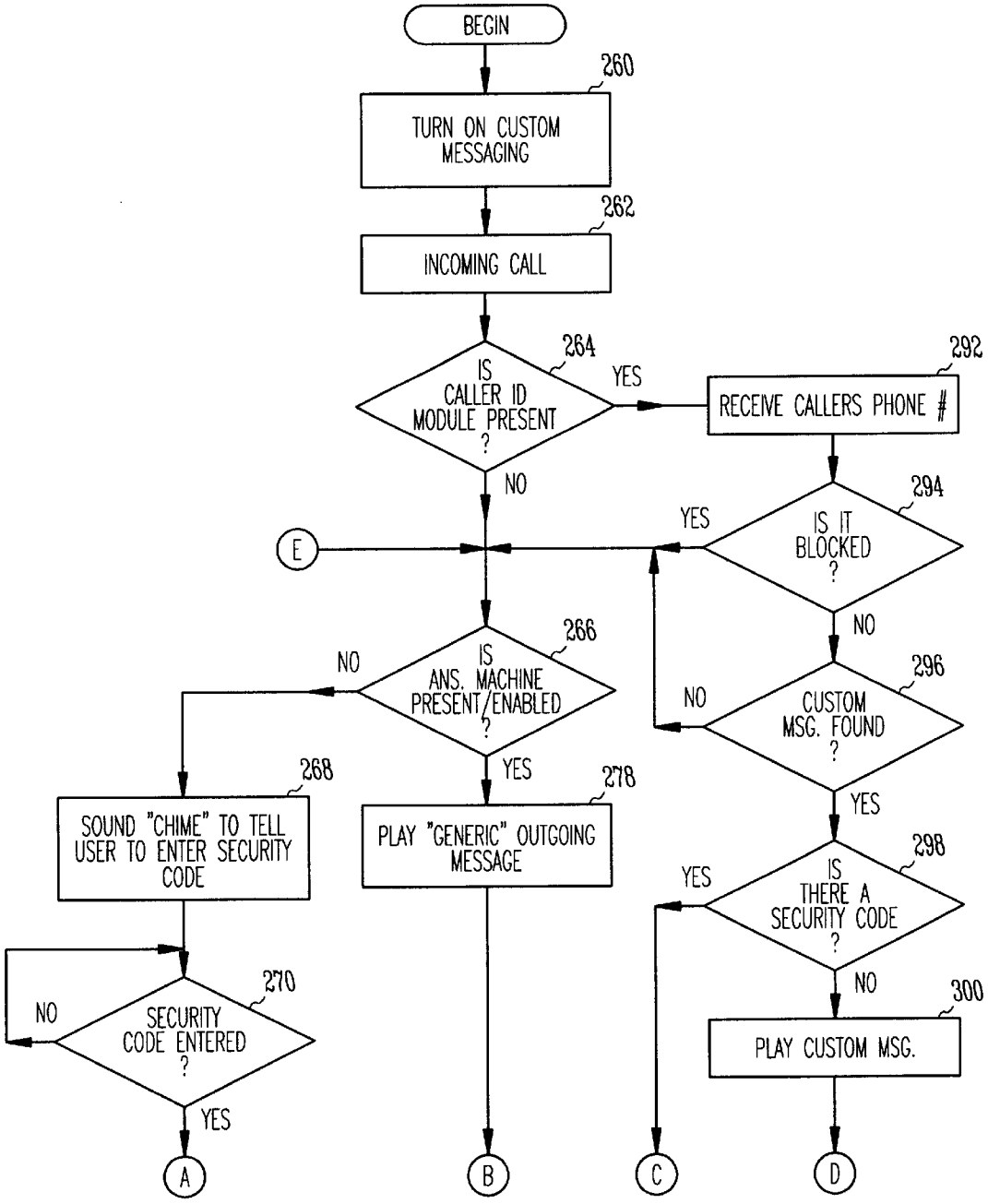
BEGIN
260
TURN ON CUSTOM MESSAGING
262
INCOMING CALL
264
IS CALLER ID MODULE PRESENT ?
YES
292
RECEIVE CALLERS PHONE #
NO
294
IS IT BLOCKED ?
YES
E
NO
266
IS ANS. MACHINE PRESENT/ENABLED ?
NO
296
CUSTOM MSG. FOUND ?
NO
268
SOUND "CHIME" TO TELL USER TO ENTER SECURITY CODE
YES
278
PLAY "GENERIC" OUTGOING MESSAGE
YES
298
IS THERE A SECURITY CODE ?
YES
270
SECURITY CODE ENTERED ?
NO
NO
300
PLAY CUSTOM MSG.
YES
A
B
C
D

Fig.16A

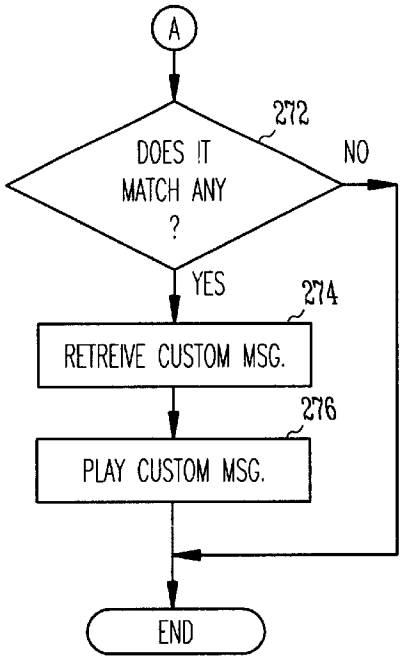


Fig.16B

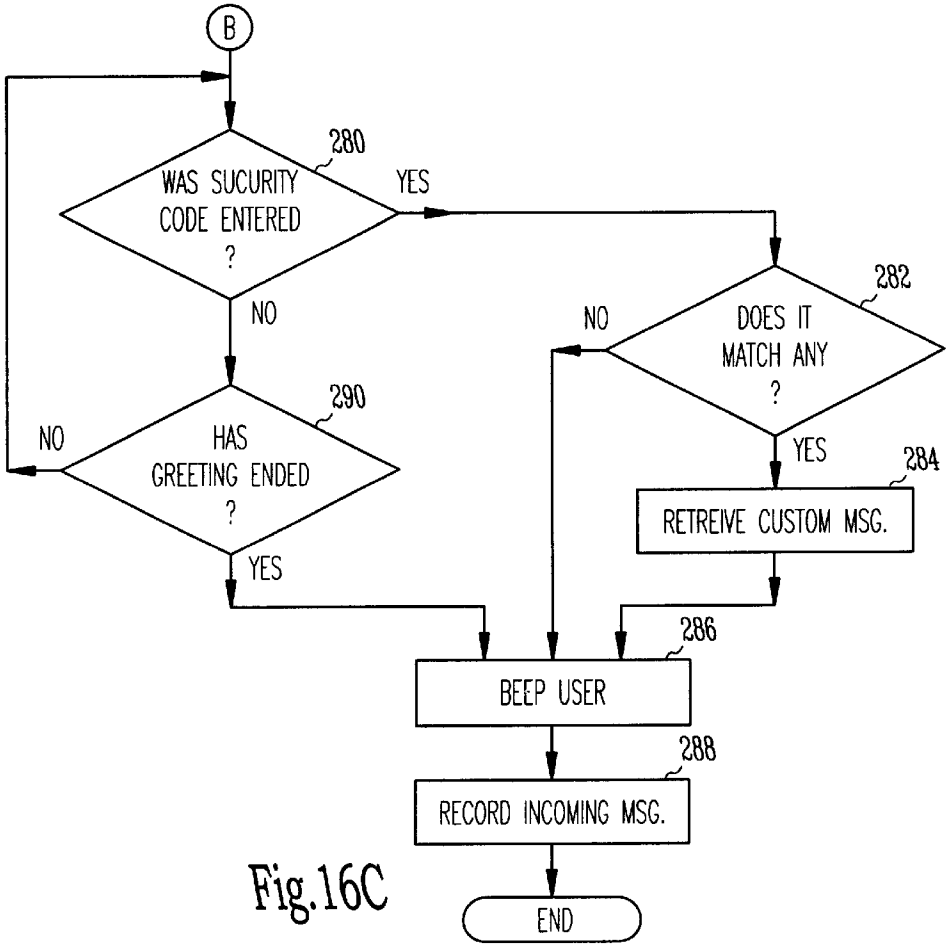


Fig.16C

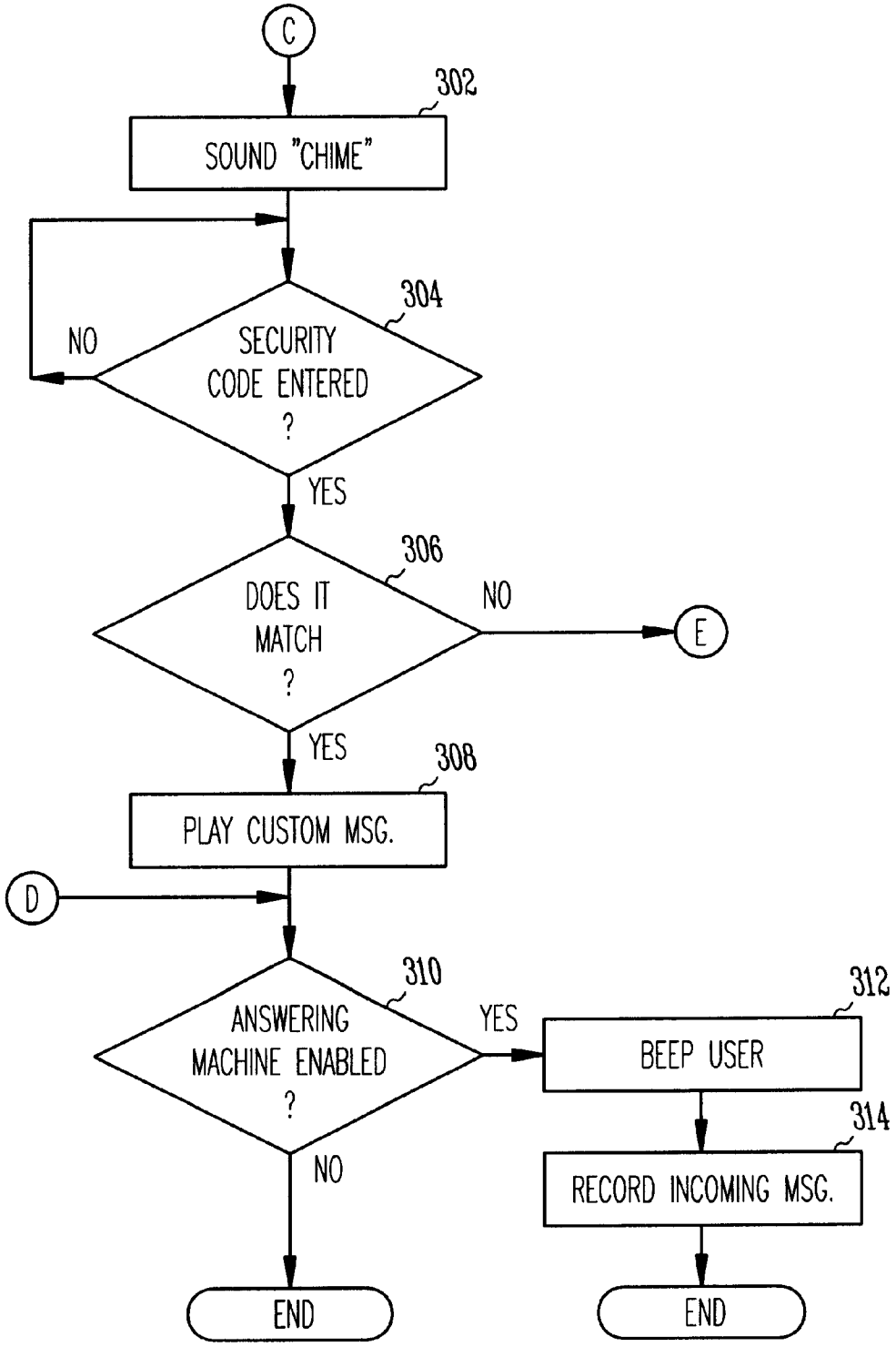
C
302
SOUND "CHIME"
304
NO
SECURITY CODE ENTERED ?
YES
306
DOES IT MATCH ?
NO
E
YES
308
PLAY CUSTOM MSG.
D
310
ANSWERING MACHINE ENABLED ?
YES
312
BEEP USER
314
RECORD INCOMING MSG.
NO
END
END

Fig.16D

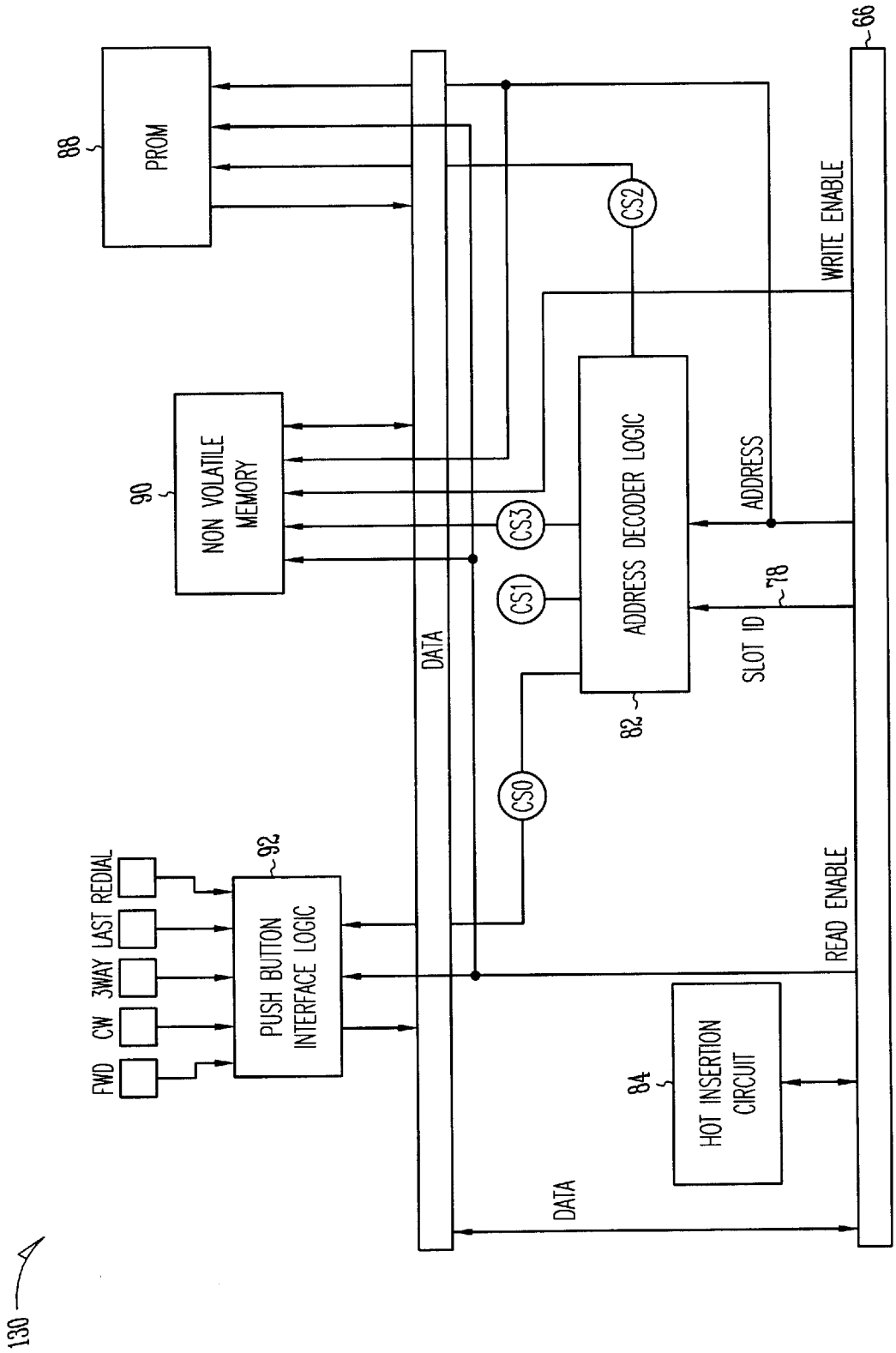
130
88
PROM
90
NON VOLATILE MEMORY
92
PUSH BUTTON INTERFACE LOGIC
FWD
CW
3WAY
LAST
REDIAL
CS0
CS1
CS2
CS3
82
ADDRESS DECODER LOGIC
84
HOT INSERTION CIRCUIT
DATA
DATA
ADDRESS
SLOT ID
78
WRITE ENABLE
READ ENABLE
66

Fig. 17

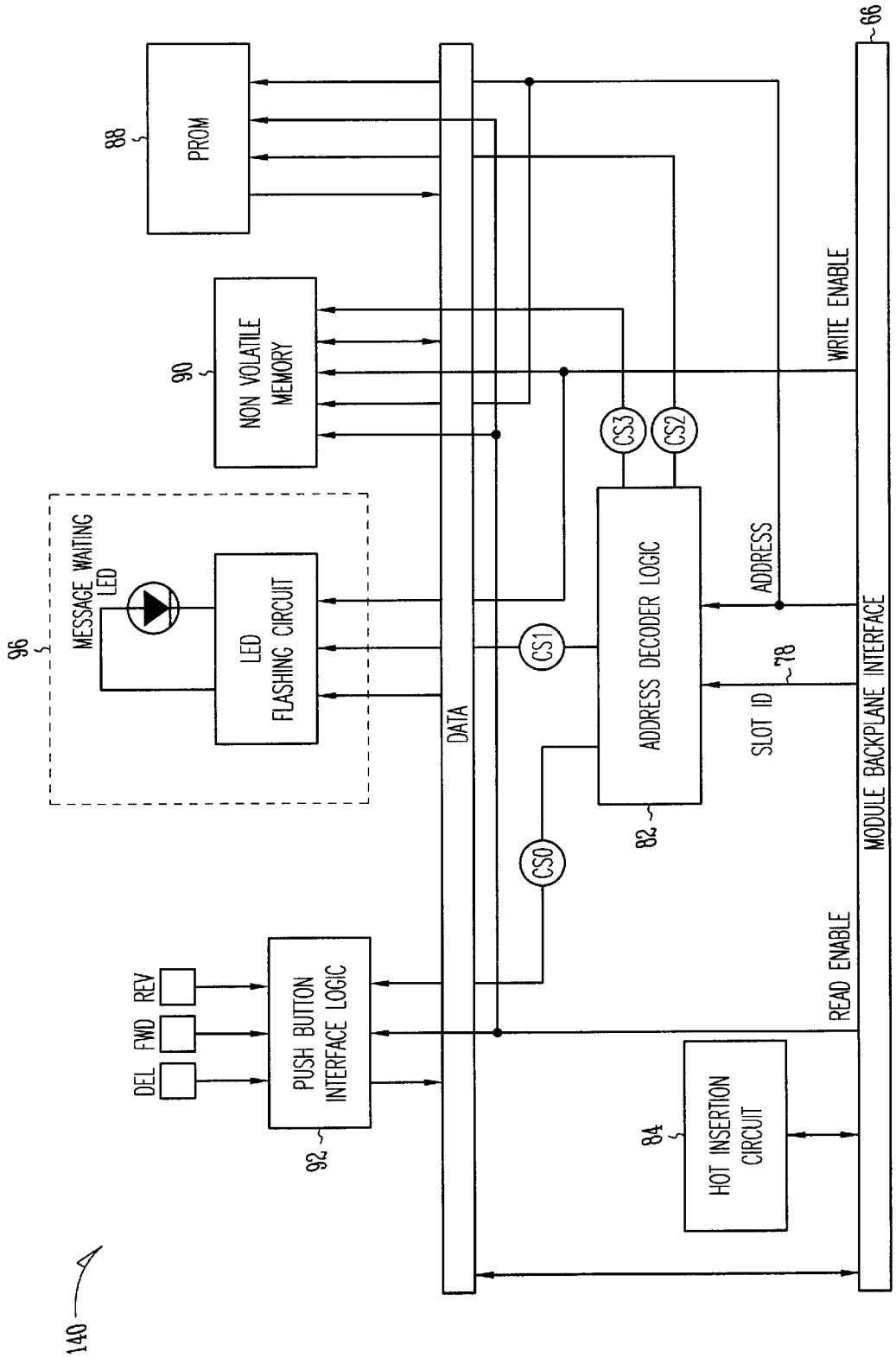
140
66
88
PROM
90
NON VOLATILE MEMORY
96
MESSAGE WAITING LED
LED FLASHING CIRCUIT
DATA
CS3
CS2
CS1
CS0
ADDRESS DECODER LOGIC
82
ADDRESS
SLOT ID
78
WRITE ENABLE
READ ENABLE
MODULE BACKPLANE INTERFACE
DEL
FWD
REV
PUSH BUTTON INTERFACE LOGIC
92
84
HOT INSERTION CIRCUIT

Fig.18

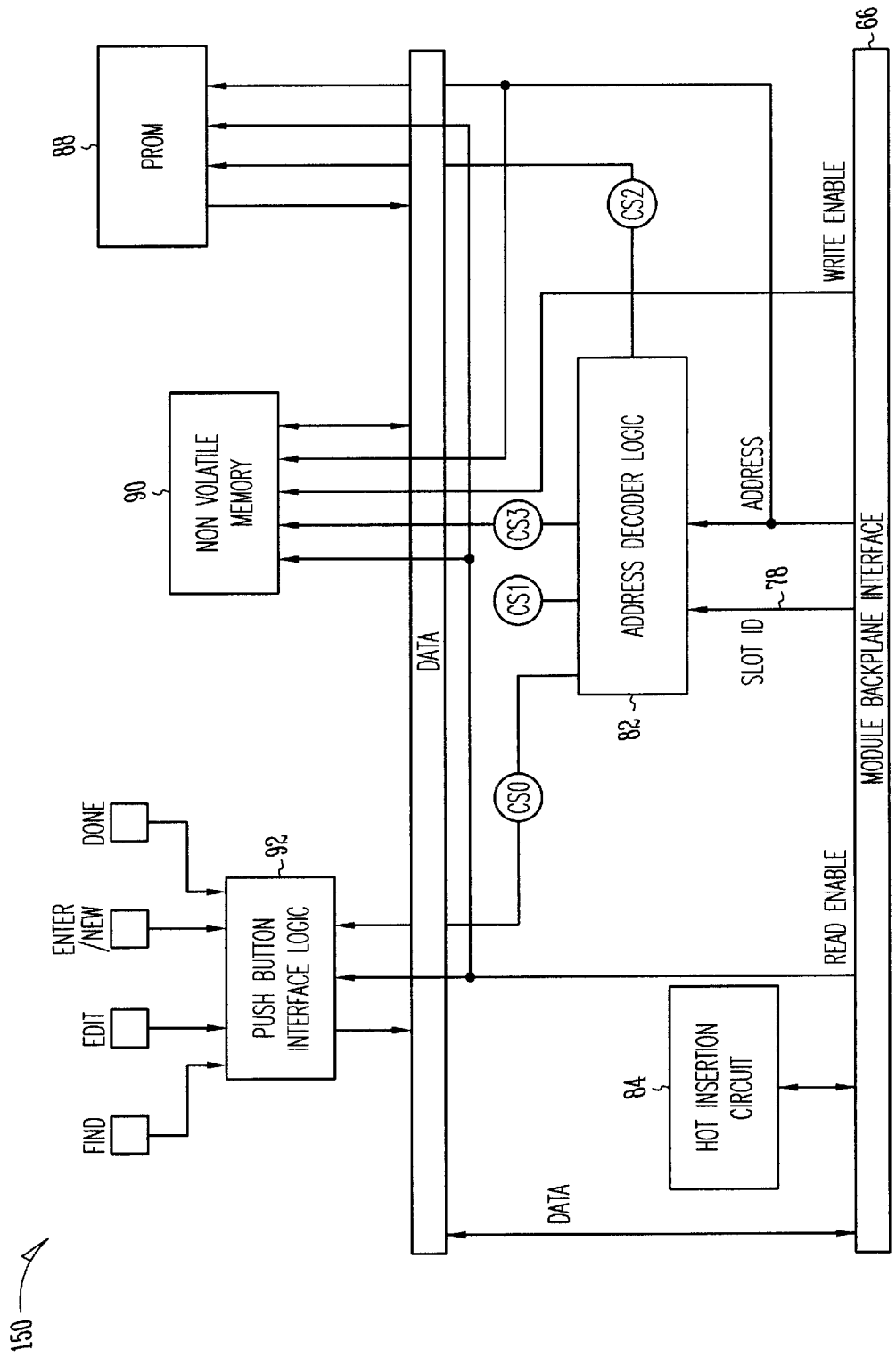
150
88
PROM
90
NON VOLATILE MEMORY
92
PUSH BUTTON INTERFACE LOGIC
DONE
ENTER /NEW
EDIT
FIND
DATA
CS0
CS1
CS2
CS3
82
ADDRESS DECODER LOGIC
ADDRESS
SLOT ID
78
84
HOT INSERTION CIRCUIT
DATA
WRITE ENABLE
READ ENABLE
66
MODULE BACKPLANE INTERFACE

Fig.19

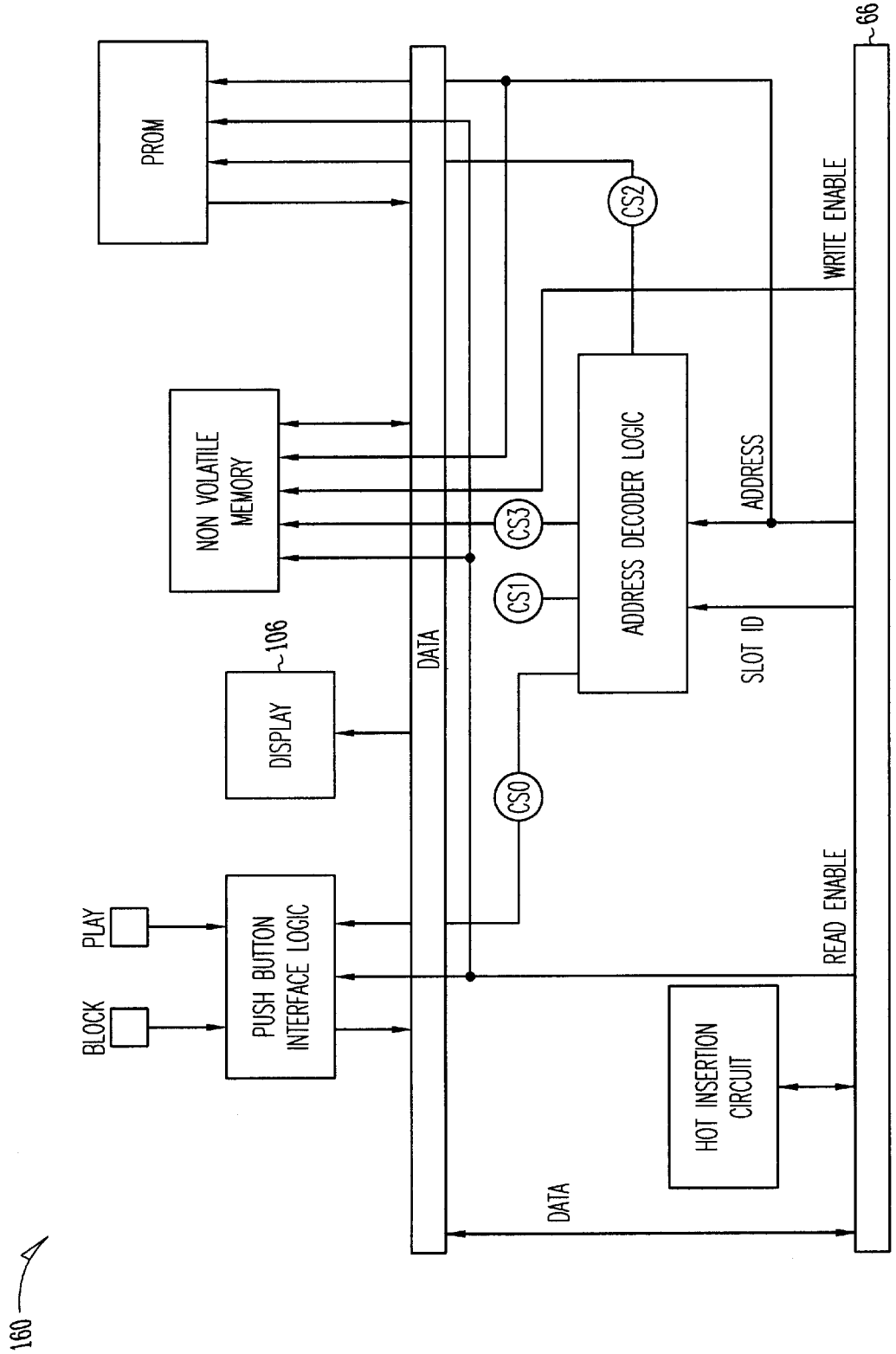
160
PROM
NON VOLATILE MEMORY
DISPLAY
106
PUSH BUTTON INTERFACE LOGIC
PLAY
BLOCK
DATA
CS0
CS1
CS2
CS3
ADDRESS DECODER LOGIC
ADDRESS
SLOT ID
WRITE ENABLE
READ ENABLE
HOT INSERTION CIRCUIT
DATA
66

Fig.20

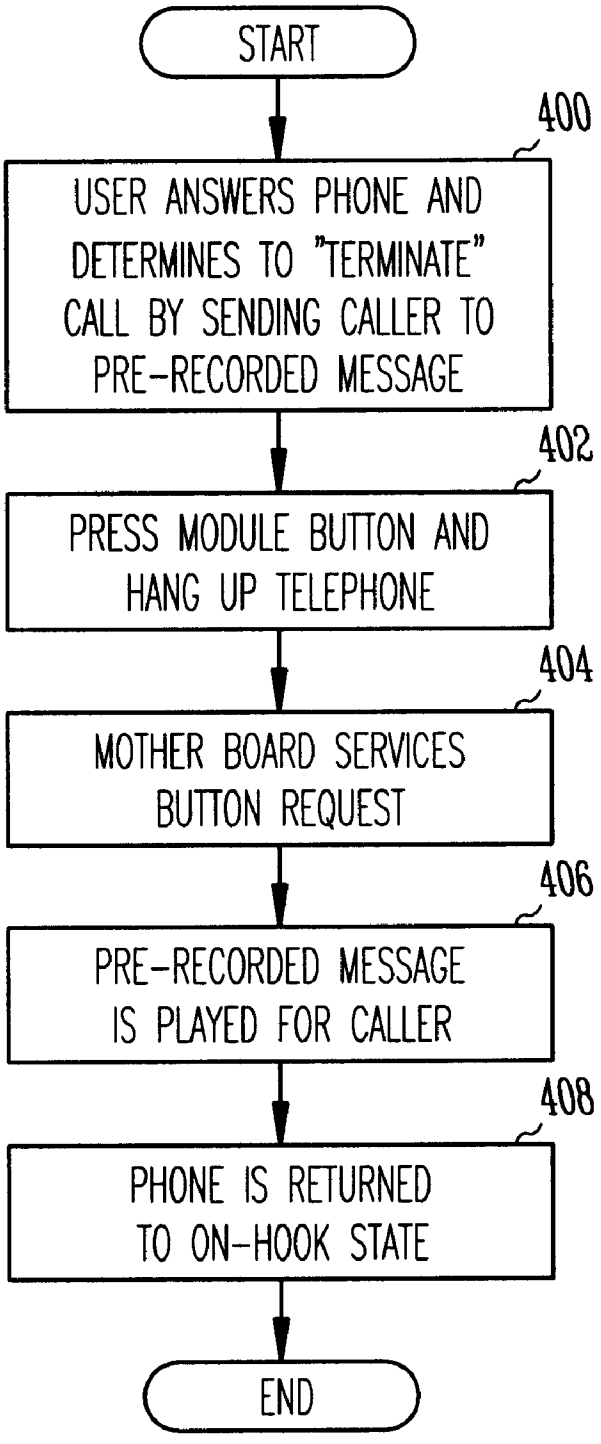
START
400
USER ANSWERS PHONE AND DETERMINES TO "TERMINATE" CALL BY SENDING CALLER TO PRE-RECORDED MESSAGE
402
PRESS MODULE BUTTON AND HANG UP TELEPHONE
404
MOTHER BOARD SERVICES BUTTON REQUEST
406
PRE-RECORDED MESSAGE IS PLAYED FOR CALLER
408
PHONE IS RETURNED TO ON-HOOK STATE
END

Fig.21

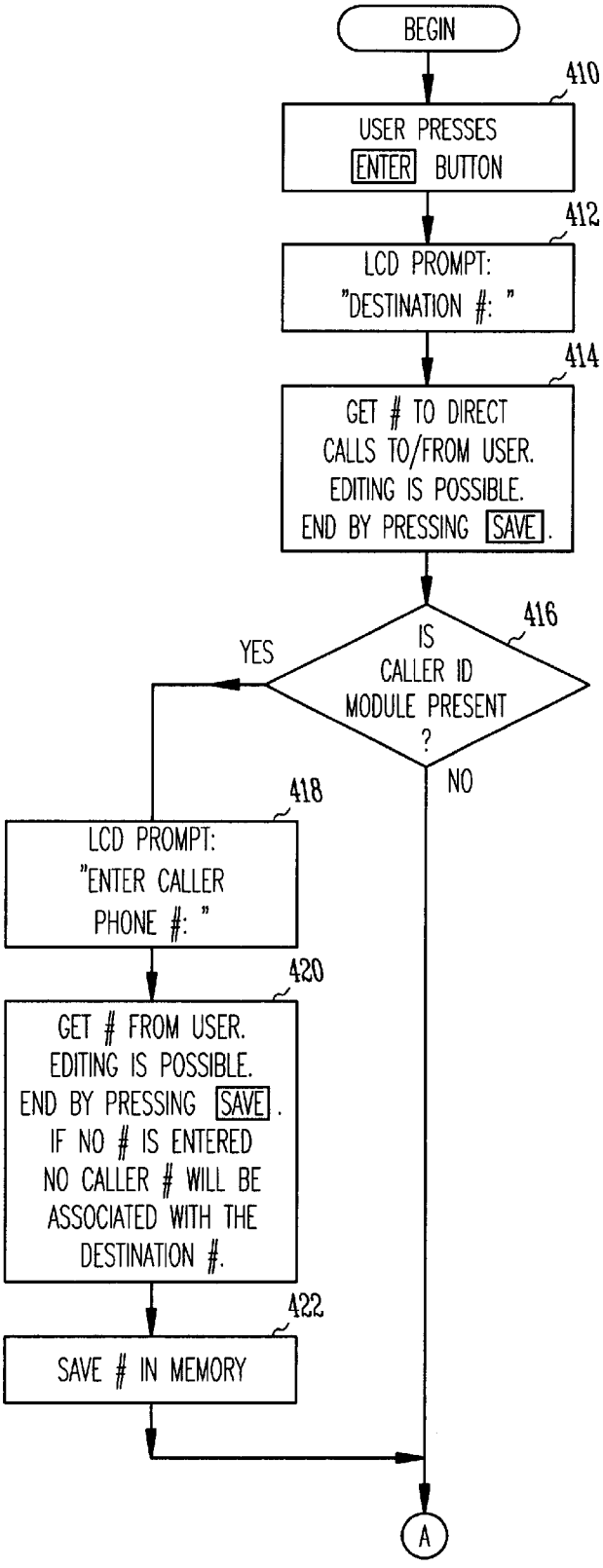
BEGIN
410
USER PRESSES [ENTER] BUTTON
412
LCD PROMPT: "DESTINATION #: "
414
GET # TO DIRECT CALLS TO/FROM USER. EDITING IS POSSIBLE. END BY PRESSING [SAVE].
416
IS CALLER ID MODULE PRESENT ?
YES
NO
418
LCD PROMPT: "ENTER CALLER PHONE #: "
420
GET # FROM USER. EDITING IS POSSIBLE. END BY PRESSING [SAVE]. IF NO # IS ENTERED NO CALLER # WILL BE ASSOCIATED WITH THE DESTINATION #.
422
SAVE # IN MEMORY
A

Fig.22A

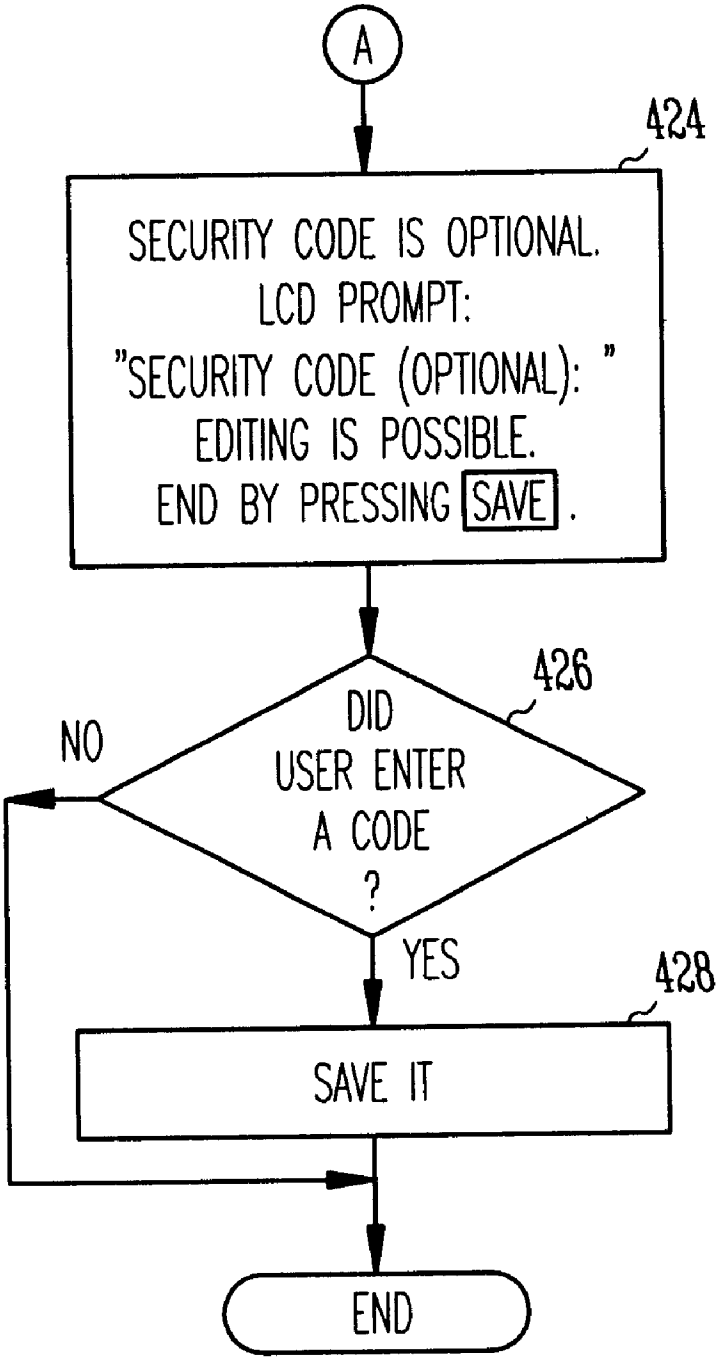
A
424
SECURITY CODE IS OPTIONAL.
LCD PROMPT:
"SECURITY CODE (OPTIONAL): "
EDITING IS POSSIBLE.
END BY PRESSING SAVE .
426
DID
USER ENTER
A CODE
?
NO
YES
428
SAVE IT
END

Fig.22B

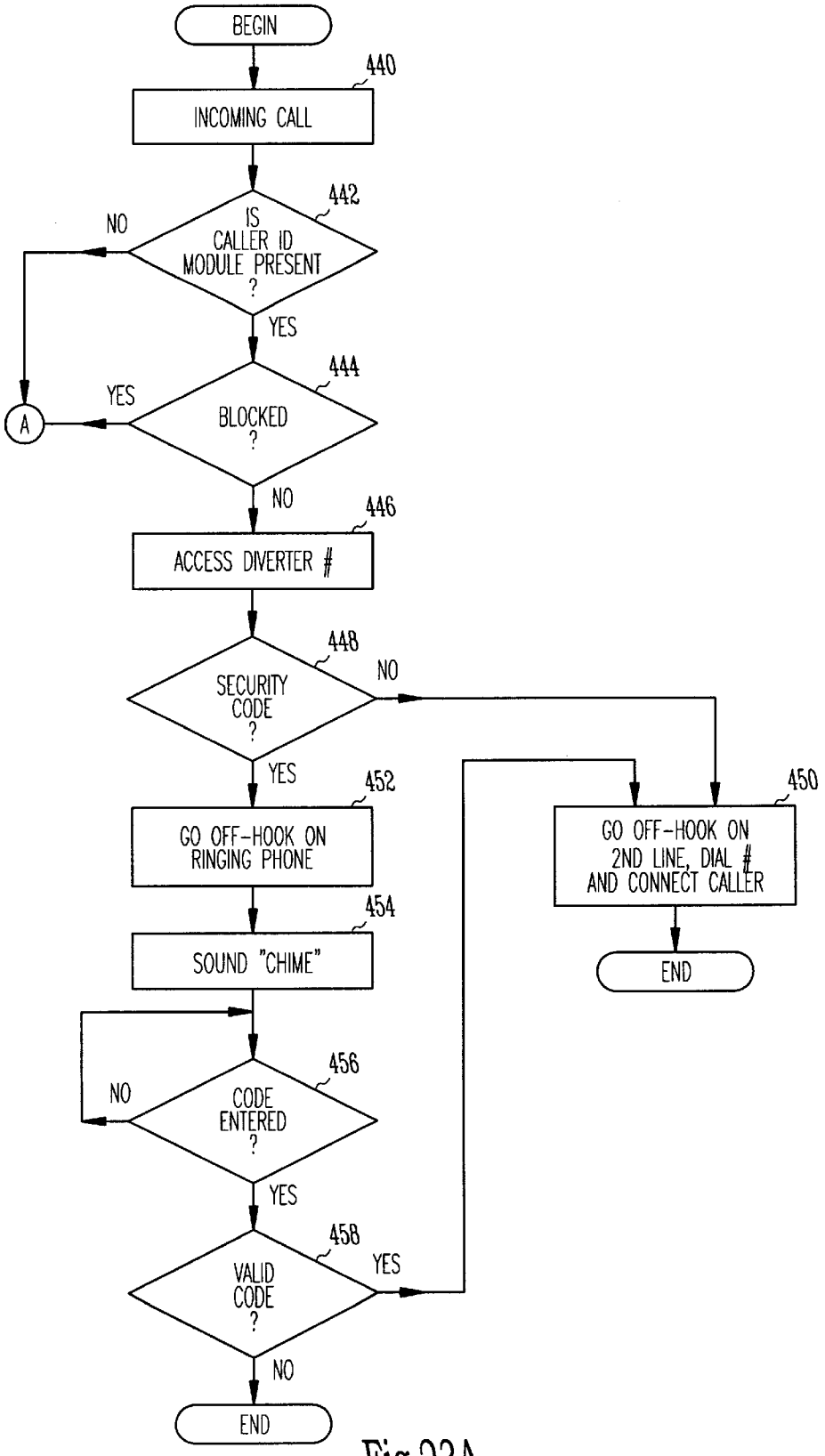
BEGIN
440
INCOMING CALL
442
IS CALLER ID MODULE PRESENT ?
NO
YES
444
BLOCKED ?
YES
A
NO
446
ACCESS DIVERTER #
448
SECURITY CODE ?
NO
YES
452
GO OFF-HOOK ON RINGING PHONE
454
SOUND "CHIME"
456
CODE ENTERED ?
NO
YES
458
VALID CODE ?
YES
NO
END
450
GO OFF-HOOK ON 2ND LINE, DIAL # AND CONNECT CALLER
END

Fig.23A

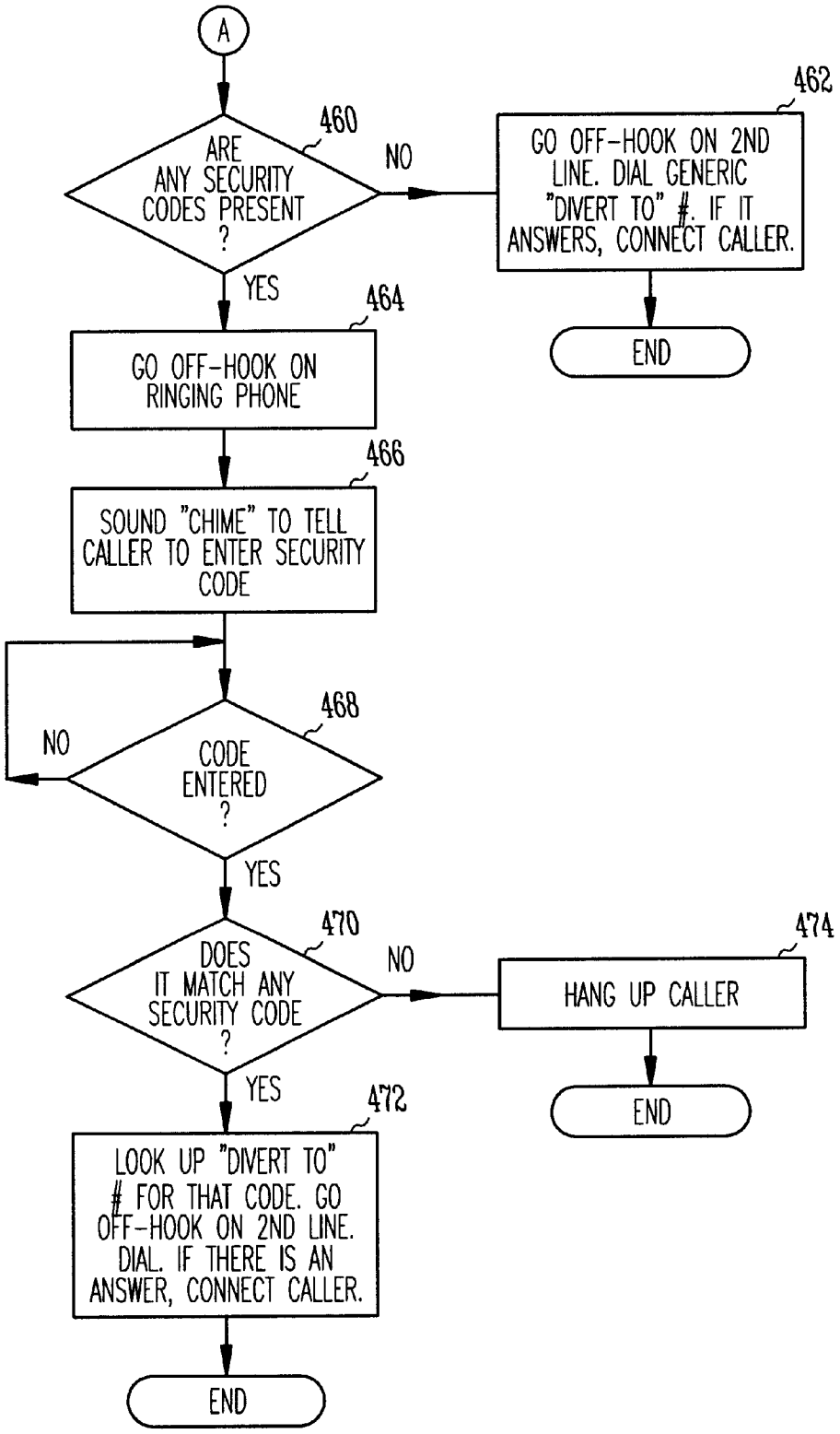
A
460
ARE ANY SECURITY CODES PRESENT ?
NO
462
GO OFF-HOOK ON 2ND LINE. DIAL GENERIC "DIVERT TO" #. IF IT ANSWERS, CONNECT CALLER.
END
YES
464
GO OFF-HOOK ON RINGING PHONE
466
SOUND "CHIME" TO TELL CALLER TO ENTER SECURITY CODE
468
NO
CODE ENTERED ?
YES
470
DOES IT MATCH ANY SECURITY CODE ?
NO
474
HANG UP CALLER
END
YES
472
LOOK UP "DIVERT TO" # FOR THAT CODE. GO OFF-HOOK ON 2ND LINE. DIAL. IF THERE IS AN ANSWER, CONNECT CALLER.
END

Fig.23B

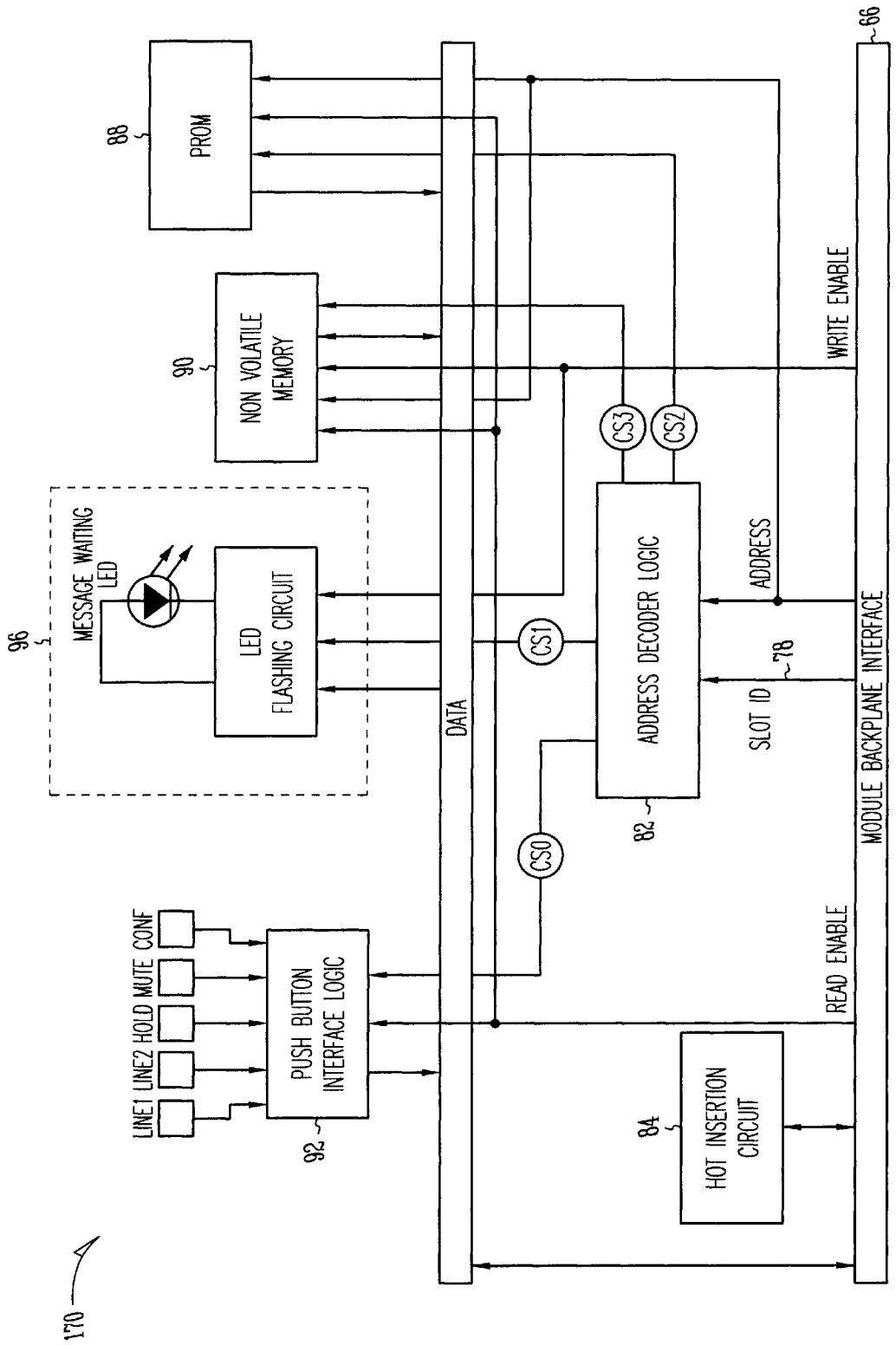
170
88
PROM
90
NON VOLATILE MEMORY
96
MESSAGE WAITING LED
LED FLASHING CIRCUIT
LINE1 LINE2 HOLD MUTE CONF
92
PUSH BUTTON INTERFACE LOGIC
DATA
CS0
CS1
CS2
CS3
82
ADDRESS DECODER LOGIC
ADDRESS
SLOT ID
78
WRITE ENABLE
READ ENABLE
84
HOT INSERTION CIRCUIT
66
MODULE BACKPLANE INTERFACE

Fig.24

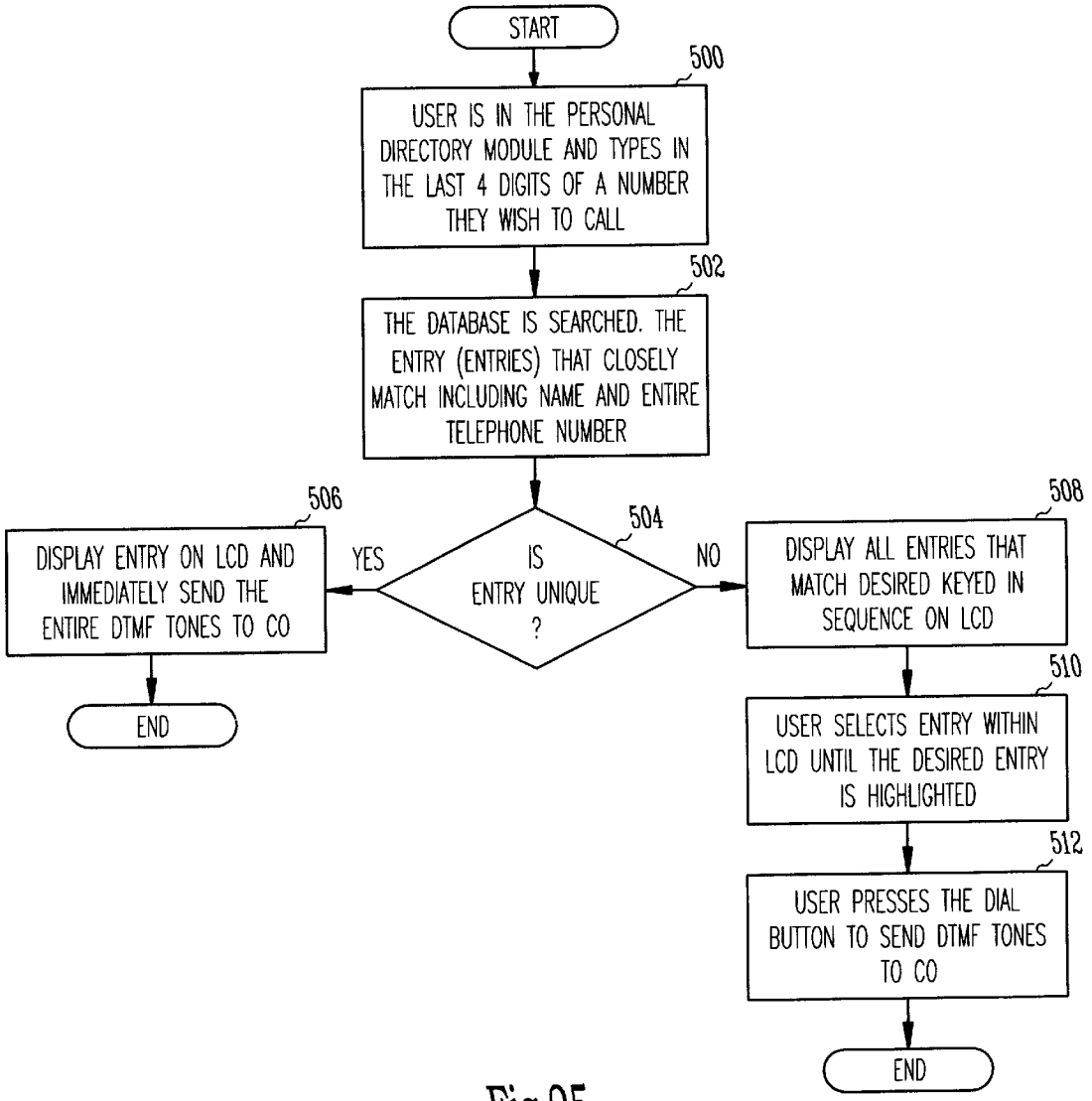
START
500
USER IS IN THE PERSONAL DIRECTORY MODULE AND TYPES IN THE LAST 4 DIGITS OF A NUMBER THEY WISH TO CALL
502
THE DATABASE IS SEARCHED. THE ENTRY (ENTRIES) THAT CLOSELY MATCH INCLUDING NAME AND ENTIRE TELEPHONE NUMBER
504
IS ENTRY UNIQUE ?
YES
NO
506
DISPLAY ENTRY ON LCD AND IMMEDIATELY SEND THE ENTIRE DTMF TONES TO CO
END
508
DISPLAY ALL ENTRIES THAT MATCH DESIRED KEYED IN SEQUENCE ON LCD
510
USER SELECTS ENTRY WITHIN LCD UNTIL THE DESIRED ENTRY IS HIGHLIGHTED
512
USER PRESSES THE DIAL BUTTON TO SEND DTMF TONES TO CO
END

Fig.25

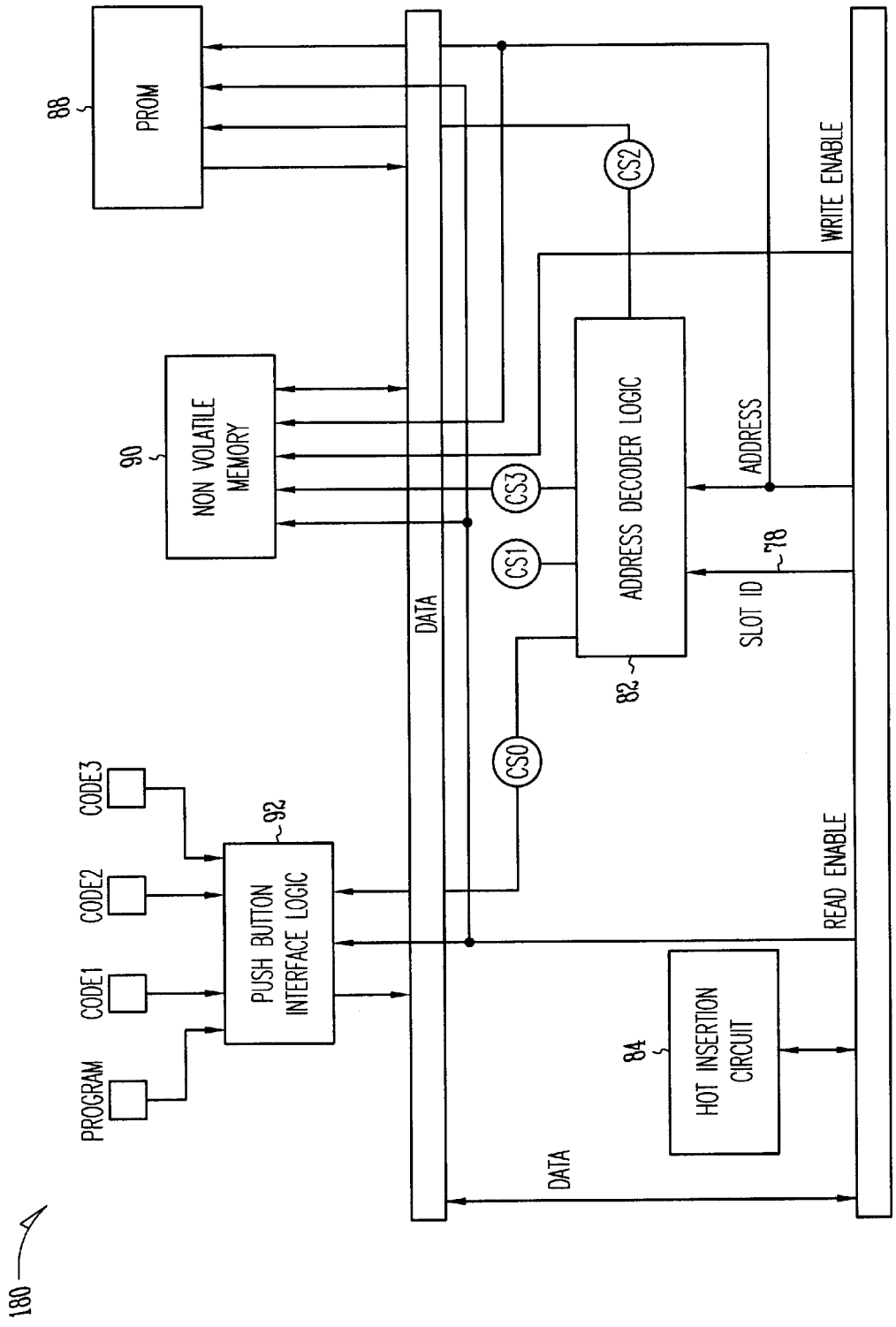
180
88
PROM
90
NON VOLATILE MEMORY
92
PUSH BUTTON INTERFACE LOGIC
PROGRAM
CODE1
CODE2
CODE3
CS0
CS1
CS2
CS3
82
ADDRESS DECODER LOGIC
78
SLOT ID
ADDRESS
WRITE ENABLE
READ ENABLE
DATA
DATA
84
HOT INSERTION CIRCUIT

Fig.26

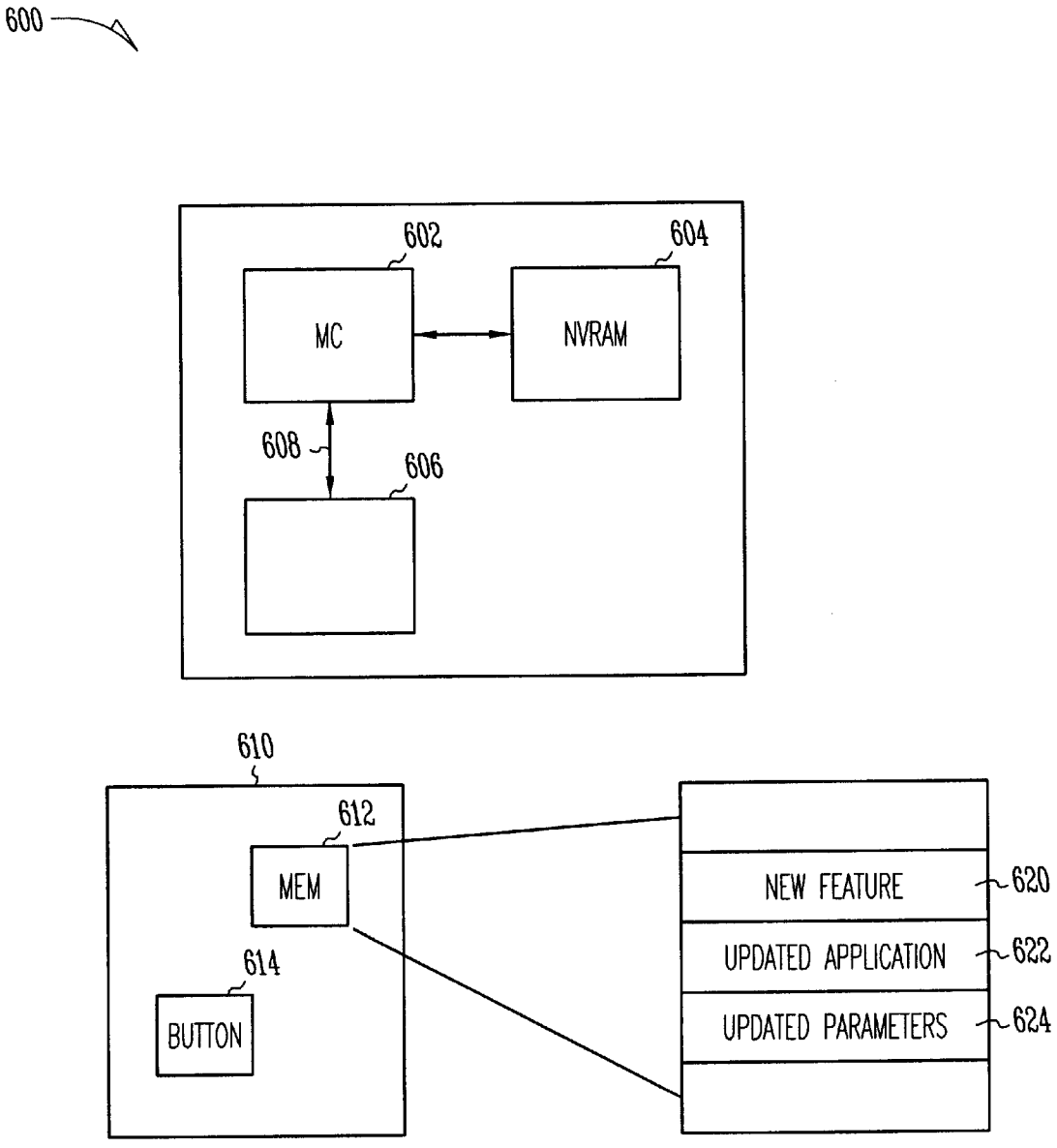
600
602
604
MC
NVRAM
608
606
610
612
MEM
614
BUTTON
NEW FEATURE
620
UPDATED APPLICATION
622
UPDATED PARAMETERS
624

Fig.27

# MODULAR TELEPHONE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related to telephony, and more particularly to a system and method for selectively adding features to a telephone.

2. Background Information

With the availability of sophisticated processing technology, there has been an explosive growth in the variety of features offered in standard telephones. Even the most inexpensive telephones include features such as redial, while more expensive models include such amenities as speed dial, caller identification (caller ID) and digital answering machines.

To date, the options for upgrading your existing telephone were limited. One could, for instance, add a separate answering machine or a separate caller ID unit to the existing telephone. Such an approach is unappealing, however, due to the increased clutter. Another option is to discard the existing telephone and replace it with a new telephone having the desired features. Such an approach is wasteful of money and may be harmful to the environment.

What is needed is a system and method for adding features to an existing telephone.

## SUMMARY OF THE INVENTION

According to one aspect of the present invention, a modular telephone is described which includes one or more module slots. The module slots are configured to receive modules adding features to the modular telephone.

According to one such aspect of the present invention, a module slot includes circuitry which reads application code or other information stored in a module installed in the module slot.

According to yet another aspect of the present invention, a module can be used to install a new feature in an electronic system having a module interface designed to receive a module having memory. The module also includes an enclosure and a connector mounted in the enclosure and configured to connect to the module connection when the enclosure is placed in proximity to the electronic system. The memory includes a plurality of memory locations. One or more of the plurality of memory connections contains information specific to the feature being installed.

According to yet another aspect of the present invention, a method of installing a new feature in an electronic system is described. An enclosure is provided and memory and a user interface are installed in the enclosure. Information relevant to the new feature into the memory installed in the enclosure is stored into the memory and subsequently transferred to the electronic system. The feature is then controlled via the user interface.

According to yet another aspect of the present invention, a method of installing a new feature in an electronic system is described. An enclosure is provided and memory is installed in the enclosure. Information relevant to the new feature into the memory installed in the enclosure is stored into the memory and subsequently transferred to the electronic system. In addition, operating system code stored in the memory is transferred to memory in the electronic system and used to upgrade the operating system of the electronic system.

According to yet another aspect of the present invention, a peripheral device is described which operates in conjunction with a telephone to add telephone features to the telephone. The peripheral device includes one or more module slots, a processing unit and a telephone interface which operate in cooperation with the processing unit to provide a new feature based on information read from a module installed in one of the module slots. Each module slot is configured to receive a module adding features to the telephone. The telephone module includes a relay for disconnecting the telephone from a central office.



According to yet another aspect of the present invention, a numeric data entry device is described which operates under a first method to transfer information over a telephone connection and which operates under a second method to transfer information to a microprocessor, the data entry device comprising a keypad and a dual tone multiple frequency (DTMF) disable feature for disabling DTMF tones while permitting transfer of data from the keypad to the microprocessor.

According to yet another aspect of the present invention, a distinctive ring system and method is described. Data representative of a plurality of distinctive incoming call signals is stored in memory. One or more of the distinctive incoming call signals are associated with caller identifiers (e.g., caller IDs or user keyed or biometric information), wherein associating includes associating a first distinctive incoming call signal with a first caller identifier. A first caller identifier is received and the data is accessed as a function of the first caller identifier. The first distinctive incoming call signal is then generated from the accessed data.

According to yet another aspect of the present invention, a system and method diverting a telephone call is described. Data representative of a plurality of messages is stored in memory and one or more of the messages are associated with caller identifiers (e.g., caller IDs or user keyed or biometric information). A signal including the first caller identifier is received and the data is accessed as a function of the first caller identifier. Finally, the first message is played.

According to yet another aspect of the present invention, a system and method diverting a telephone call is described. Data representative of a plurality of messages is stored in memory and one or more of the messages are associated with caller identifiers (e.g., caller IDs or user keyed or biometric information). A signal including the first caller identifier is received and, if an expected security code is received, the data is accessed as a function of the first caller identifier and the first message is played.

According to yet another aspect of the present invention, a system and method diverting a telephone call is described. Data representative of a plurality of telephone numbers is stored in memory and one or more of the telephone numbers are associated with caller identifiers (e.g., caller IDs or user keyed or biometric information). A signal including the first caller identifier is received and the data is accessed as a function of the first caller identifier. The call is then transferred to the first telephone number.

According to yet another aspect of the present invention, a system and method diverting a telephone call is described. Data representative of a plurality of telephone numbers is stored in memory and one or more of the telephone numbers are associated with caller identifiers. A signal including the first caller identifier is received and, if an expected security code is received, the data is accessed as a function of the first caller identifier. The call is then transferred to the first telephone number.

According to yet another aspect of the present invention, a system and method of speed dialing an area code is

described. Data representative of a plurality of area codes is stored in memory. Each of the plurality of the area codes is associated with a button, wherein associating includes associating a first area code with a button. The first button is depressed and a signal representative of the first area code is driven on the telephone line.

According to yet another aspect of the present invention, a system and method of speed dialing a telephone number is described. Data representative of a plurality of telephone numbers is stored in memory. When a string of numbers is entered, the string of numbers is compared against the telephone numbers stored in memory. A list of telephone numbers which match the string of numbers is displayed and a selected one of the listed numbers is then dialed.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an embodiment of modular telephone system **10**;

FIG. **2** illustrates a handset which can be used with modular telephone system **10** of FIG. **1**;

FIGS. **3***a* and **3***b* illustrate alternate embodiments of a circuit **40** which can be used with telephone system **10** of FIG. **1**;

FIGS. **4***a* and **4***b* illustrate alternate embodiments of a module which can be used in modular telephone system **10**;

FIG. **5** illustrates a vector interrupt service routine which can be used to transfer data from a module to the base unit on power up;

FIGS. **6***a*–**6***c* illustrate selected embodiments of packaging used for the modules of system **10**;

FIG. **7** illustrates a button service routine which can be used to service buttons mounted on either the base unit or the modules;

FIG. **8** illustrates another embodiment of modular telephone system **10**;

FIGS. **9***a*–**9***c* illustrate another embodiment of modular telephone system **10**;

FIG. **10** illustrates another embodiment of modular telephone system **10**;

FIG. **11***a* illustrates a peripheral device embodiment used to add features to a telephone;

FIG. **11***b* illustrates one embodiment of the peripheral device of FIG. **11***a;*

FIG. **11***c* illustrates a protocol which can be used in the embodiment of the peripheral device shown in FIG. **11***b;*

FIG. **12** illustrates an answering machine/message manager module which can be used in modular telephone system **10**;

FIGS. **13***a* and **13***b* illustrate a custom message entry protocol which can be used in the module of FIG. **12**;

FIG. **14** illustrates a voice message service module which can be used in modular telephone system **10**;

FIG. **15** illustrates a protocol used to review or delete a message in the modules of FIGS. **12** and **14**;

FIGS. **16***a–d* illustrate a protocol used to play custom messages in the modules of FIGS. **12** and **14**;

FIG. **17** illustrates a central office feature manager service module which can be used in modular telephone system **10**;

FIG. **18** illustrates a caller ID module which can be used in modular telephone system **10**;

FIG. **19** illustrates a personal directory module which can be used in modular telephone system **10**;

FIG. **20** illustrates a diverter module which can be used in modular telephone system **10**;

FIG. **21** illustrates a protocol used to divert calls using the diverter module of FIG. **20**;

FIGS. **22***a* and *b* illustrate a protocol used to enter telephone numbers of calls to be diverted using the diverter module of FIG. **20**;

FIGS. **23***a* and *b* illustrate a protocol used to forward calls to another number using the diverter module of FIG. **20**;

FIG. **24** illustrates a three way calling module which can be used in modular telephone system **10**;

FIG. **25** illustrates short dialing in a module such as is shown in FIG. **19**;

FIG. **26** illustrates an area code dialing module which can be used in modular telephone system **10**; and

FIG. **27** illustrates an electronic system which uses modules to add features to the system.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention. Like reference numbers refer to similar items in all the figures.

A modular telephone system **10** is shown generally in FIG. **1**. In FIG. **1**, modular telephone system **10** includes a base unit **12** with four module slots **14** (shown as **14.1**–**14.4**) on the top side of base unit **12** and three module slots **16** (shown as **16.1**–**16.3**) on the left side of base unit **12**. Each module slot **14**, **16** is configured to receive a module (not shown) capable of adding features to modular telephone system **10**. System **10** also includes telephone circuitry (not shown) connected to a data entry device **18**, a display **20**, a handset **22** and a telephone system interface **24**.

In one embodiment, telephone system interface **24** connects to a network using standards such as, e.g., POTS and ISDN. In one such embodiment, as is shown in FIG. **1**, telephone system interface **24** is connected to the back side of base unit **12**.

In one embodiment, as is illustrated in FIG. **2**, handset **22** includes a receiver **30**, a microphone **32** and a cord **34** connecting handset **22** to base unit **12**. In another embodiment, handset **22** is connected to base unit **12** using an RF, acoustic, optical, infrared or other electromagnetic signal.

FIGS. **3***a* and **3***b* illustrate alternate embodiments of a base unit subsystem **40** which can be used with telephone system **10** of FIG. **1**. In one embodiment, subsystem **40** includes telephone subsystem **50**, memory **46**, nonvolatile memory **48**, processing unit (CPU) **44**, data entry unit **60** and one or more module slot interfaces **42**. In one such embodiment a display unit **68** is also included to provide feedback to the user. Display unit **68** may be formed as a LED, LCD, video or other such display device. In one embodiment, display unit **68** is a LCD display capable of displaying the current data and time as well as several lines of information.

In one embodiment, telephone subsystem **50** includes circuitry needed to form a basic POTS telephone. In another embodiment, telephone subsystem **50** is designed to connect to a PBX system.

Telephone subsystem **50** includes microphone input **54**, speaker output **52**, line interface circuitry **58** and sound

source **56**. Sound source **56** may be, for example, a piezo sound element, a speaker, or any other sound source. Line interface **58** can be connected to a telephone interface **24**, such as is shown in FIG. **1**. In one embodiment, telephone subsystem **50** and processing unit **44** are implemented using integrated circuit devices in the manner known to those skilled in the telecommunications art. In another embodiment, substantial portions of telephone subsystem **50** and processing unit **44** are formed using a single, suitably programmed, integrated circuit (e.g., a digital signal processing device, microprocessor or microcontroller).

In one embodiment, data entry unit **60** is a keypad. It should be apparent that a data entry system such as a mouse, pointer or stylus or any other known techniques for data entry in graphical or text environment could be used. In one such embodiment, data entry unit **60** and display unit **68** are combined into a touch screen. In another embodiment, soft keys are shown on display unit **68**. In such an embodiment, data entry unit **60** may simply be a set of buttons corresponding to the soft keys displayed on display unit **68**. Each button is associated with one of the soft keys displayed by display unit **68**; telephone subsystem **50** and processing unit **44** operate in conjunction with display unit **68**, as needed, to translate a touch on a button into the activity displayed by its associated soft key.

In one embodiment, a module adding new features to system **10** is connected through a module slot **14** or **16** to a module slot interface **42**. In one such embodiment, processing unit **44** operates in cooperation with module slot interface **42** to read information from a module installed in one of the module slots into memory **46**. In the example shown in FIGS. **3***a* and **3***b*, processing unit **44** is connected to module slot interface **42** over mother board bus **62**, module interface **64** and module backplane interface **66**. In one set of embodiments, module backplane interface **66** is a standard interface such as PC/**104**, USB or PCMCIA. Other methods of connecting the components of circuit **40** will be readily envisioned by one skilled in the art of telecommunications or data processing.

FIG. **3***b* illustrates an embodiment of subsystem **40** where display unit **68** is housed in a separate display module **70**. In one such embodiment, display unit **68** and other circuitry aboard module **70**, when plugged into its respective module slot **14**, are connected to processing unit **44** and telephone circuit **51** over mother board bus **62**, module backplane interface **64** and module backplane **66**. In another such embodiment, module **70** is connected directly to module backplane interface **66** and, through module interface **64**, to mother board bus **62**.

FIGS. **4***a* and **4***b* illustrates two embodiments of a generic module **80** which can be used in modular telephone system **10** of FIG. **1**. In the embodiments shown in FIGS. **4***a* and **4***b*, each module **80** is address independent and capable of being inserted into a powered-up base unit subsystem **40** (i.e., it is hot insertion capable). In one such embodiment, module **80** includes address decoder logic **82**, hot insertion circuitry **84** and memory **86**.

In one embodiment of the modules **80** shown in FIGS. **4***a* and **4***b*, address decoder logic **82** includes one or more slot ID inputs **78** used to identify the module slot (**14**, **16**) into which module **80** is inserted. For instance, in one embodiment, address decoder logic **82** accepts a three or four bit slot ID from slot ID inputs **78**. The slot ID is a binary value that is unique to each slot in the backplane, and acts as the most significant (MS) bits of the backplane address bus. In one embodiment, when the three or four most significant bits of the address match the slot ID, processing unit **44** is addressing the module. Data is then read from memory **86** as a function of the appropriate number of least significant bits on the address bus. Chip selects are generated as needed within module **80** to access particular memory devices within memory **86**. In addition, address decoding may be used to query the status of various other elements within module **80** (such as button interface **92** or self test logic, if any). In one such embodiment, I/O and memory space are designed to be uniform across all modules. (Of course, not all chip selects will be used on every module.)

Memory **86** may include both volatile and nonvolatile memory. In addition, memory **86** may include two or more types of nonvolatile memory. In one embodiment, memory **86** includes a read-only memory **88** (e.g., PROM or ROM) and nonvolatile memory **90** (e.g., FLASH memory, EEPROM, magnetic or optical media). Read-only memory **88** is used to store data and application information which is unlikely to change. Nonvolatile memory **90** may be used, if necessary, to store data and application code which may be upgraded. In one embodiment, nonvolatile memory **90** is FLASH or electrically-erasable memory and module **80** includes circuitry for reprogramming memory **90**. Such an embodiment is useful for making quick revisions to the application stored in module **80**.

In one embodiment read-only memory **88** is an EPROM which contains all of the program code needed by processing unit **44** to implement a particular feature. In addition, memory **88** stores a serial number, security code, and version number associated with the particular feature being added to system **10**.

Nonvolatile memory **90** is optional. If present, it is used to store user-defined data such as telephone numbers. If, however, memory **90** is too expensive to put on individual modules, the information can be stored by CPU **44** in centralized nonvolatile memory **48**.

Returning to FIG. **4***a*, in one embodiment module **80** includes a push button interface **92** and one or more externally mounted buttons **94**. In such an embodiment, push button interface **92** debounces the mechanical switch contacts of buttons **94**, generates an interrupt to the CPU when a pushbutton is pressed, and captures the switch states (pressed/not pressed) in a register. That register can then be queried by processor **44** by reading at a predefined address (as is detailed above).

In one embodiment hot-insertion circuitry **84** controls power sequencing on module **80** when module **80** is inserted or removed from system **10**. This is done to prevent damage to electronic devices when then are first connected to the system **10** power supply.

In one embodiment, such as is shown in FIG. **4***b*, module **80** includes a feedback mechanism **96** used to give the user an indication of operation of module **80**. Feedback mechanism could include visual (e.g., flashing LED), aural (e.g., beeper or tone generator) or tactile (e.g., vibrator) forms of feedback. In one visual feedback embodiment, feedback mechanism **96** includes a flashing LED circuit which is enabled and disabled by the processing unit **44** writing to a single bit register. Flashing is controlled by feedback mechanism **96**, i.e., the processing unit **44** does not have to "manually" turn the LED on and off at some interval. Other bits of data at the same address could be used to make the flashing circuit programmable (e.g., variable flash rate, flash/always on, etc.).

In one embodiment, pushbutton interface **92**, feedback mechanism **96**, address decoder logic **82** and any necessary

bus buffers are combined into a single physical device for cost reduction. Such a device can be formed from an ASIC, FPGA or PLD.

In operation, processing unit **44** reads application code and configuration information from memory **86** and stores the relevant data in RAM **46**. Processing unit **44** executes the application code out of RAM **46** to provide the desired feature. FIG. **5** illustrates one embodiment of a routine used to transfer data from module **80** to processing unit **44**.

At **200**, module **80** powers up and generates a vector interrupt service routine (ISR). Processing unit **44** reads the module address register at **202** to determine which module slot **14** or **16** was made active. At **204**, processing unit **44** reads a unique identifier stored in module **80** and determines at **206** whether the module is a valid module. If the module is not a valid module, processing unit **44** displays an error message on display **68** at **208**.

If the module is, however, a valid module, processing unit **44** moves to **210** and reads application code and help information from module **80**. At **212** the application code and help information are stored into nonvolatile memory **48** for subsequent access by processing unit **44**.

In some embodiments, updates to code stored in memory **48** of subsystem **40** are read from module **80** at **210** when that module is first powered up. The information is then stored to memory **48**. Such an approach can be used to provide updates to system **10** at the time new features are added. In one such embodiment, processing unit **44** queries a newly added module to determine if it has a newer version of the operating system than that already installed in system **10**. If so, the newer version is transferred to memory **48** and installed. In such an embodiment, each module may contain a version of the operating system and system parameters; processing unit **44** tracks the versions stored on each module and only updates memory **44** if it detects a newer version.

In another embodiment, new versions of the operating system and any system parameters are downloaded through telephone system interface **24** (e.g., through a bulletin board or 800 number accessed through the POTS network. In one such embodiment, circuitry necessary to provide caller ID in subsystem **50** is upgraded to full modem capability. The modem connects to, for instance, the bulletin board, checks for newer versions of application code and downloads that code to memory **48**. In one such embodiment, nonvolatile memory **90** in module **80** is updated to the latest revision of its own application code via this process.

FIGS. **6***a–c* illustrate selected embodiments of packaging used for modules **80**. In the simplest embodiment, such as is shown in FIG. **6***a,* module **80** is packaged in an approximately rectangular package **100** such as a PCMCIA package. A connector **102** is plugged into slot interface **42** to add the feature provided by module **80**.

FIG. **6***b* illustrates a package **100** having two push buttons **94** and three visual indicators **104** (e.g., LEDs). In one embodiment, a user accesses certain aspects of the added feature by depressing one or both of the push buttons **94**. Visual indicators **104** provide feedback that some action is indeed taking place. In the embodiment shown in FIG. **6***b,* connector **102** is at the opposite end of the package from push buttons **94**.

FIG. **6***c* illustrates a package **100** having two push buttons **94** and a single display element **106** (e.g., an LCD). As in the embodiment shown in FIG. **6***b,* in this embodiment a user accesses certain aspects of the added feature by depressing one or both of the push buttons **94**. Text or graphical information displayed in display element **106** provides feedback that some action is indeed taking place. (For example, the ID of an incoming caller could be displayed in display element **106**.)

A button service routine which can be used to process any of the buttons base unit **40** or in module **80** is shown in FIG. **7**. In FIG. **7**, at **190** a button is depressed. The button is mechanically debounced and, at **192**, a flag is set in a register in logic **92** identifying the button depressed. Module **80** then, at **194**, generates an interrupt to CPU **44**. At **196**, an interrupt service routine in CPU **44** reads the register on module **80** to determine which button was pressed and, at **198**, the register flag is reset.

In one embodiment, base unit **12** further includes a speaker phone interface **26**. In one such embodiment, speaker phone interface **26** includes a speaker **27** and a microphone **28** mounted permanently within base unit **12**. In another such embodiment, speaker phone interface **26** is placed within a special module which can be inserted and removed from base unit **12**. One example of such an embodiment is shown in FIG. **8**. By placing speaker phone interface **26** in a module one can upgrade the speaker phone capabilities of speaker phone interface **26** (e.g., with better speaker or microphone technology, or with increased functionality) without having to replace the telephone.

In one such module-based speaker phone embodiment, base unit **12** includes a speaker phone module slot **29** for receiving the special speaker phone interface module. Connection to the speaker phone may be made through an analog connection or digitally via address decoder logic **82** as shown in FIG. **4**. Data to be transmitted and received from the digital speaker phone interface module is digitized and placed within the address space allocated to the module.

Modular telephone system **10** can be packaged in a number of ways. A wall-mounted embodiment of system **10** is shown in FIGS. **8***a–8c*. In the embodiment shown in FIGS. **9***a–9d,* telephone system **110** includes a base unit **112** and a handset **114**. Handset **114** is connected to base unit **112** through a cord **115** as shown in FIGS. **9***a–9c* and contains the keypad, speaker and microphone of a typical wall-mounted unit. In another embodiment, handset **114** is connected to base unit **112** through an RF or optical interface.

Base unit **112** includes a display screen **116**, a switch **118**, one or more buttons **120** and one or more module slots **122**. Module slots **122** are configured to receive modules **80**. Module slots not in use are covered with a plate **124**. Buttons **120** may have predefined functions (such as shown in FIG. **9**c) or may be soft keys whose function change in response to what is displayed on screen **116**. In one embodiment, information displayed on screen **116** is scrolled through using switch **118**.

A desk or tabletop version of system **10** is shown in FIG. **10**. In the embodiment shown in FIG. **10**, telephone system **132** includes a base unit **134** and a handset **136**. Handset **134** is connected to base unit **132** through a cord **135** as shown in FIG. **10** and contains the speaker and microphone of a typical desktop unit. In another embodiment, handset **134** is connected to base unit **132** through an RF or optical interface.

Base unit **132** includes a display screen **136**, a keypad **137**, a switch **138**, one or more buttons **140** and one or more module slots **142**. Module slots **142** are configured to receive modules **80**. Module slots not in use are covered with a plate **144**. Buttons **140** may have predefined functions or may be soft keys (such as is shown in FIG. **10**) whose function change in response to what is displayed on screen **136**. One such soft key embodiment can be understood by reviewing the cut out of screen display **136** and buttons **140** in FIG. **10**.

In one embodiment, information displayed on screen **136** is scrolled through using switch **138**.

In the embodiment shown in FIG. **10**, telephone system **130** includes a speaker **146** which can be used with speaker button **147** to initiate use of system **130** as a speaker phone. In the embodiment shown in FIG. **10**, system **130** also includes a mute button **148** for use in muting the telephone.

In one embodiment, in a variation of the speaker phone embodiment shown in FIG. **8**, a microphone is packaged with speaker **146** so that it can be added as a module to telephone system **130**. In one such embodiment, the module package also includes speaker button **147** and mute button **148**. In another embodiment, speaker button **147** and mute button **148** are soft keys accessed through screen **136** and buttons **140**. In yet another embodiment, keys in keypad **137** are used to switch between the handset and the speaker phone functions.

Telephone system **10** can also be implemented as a peripheral device **150** connected to a regular telephone unit **151**. One such embodiment (without phone unit **151**) is shown in FIG. **11***a*. In the embodiment shown in FIG. **11***a,* peripheral device **150** sits between the POTS wiring and the regular telephone unit. Device **150** includes a display screen **152**, a switch **154**, one or more buttons **156** and one or more module slots **158**. An RJ-11 jack **161** connects to the POTS system and an RJ-11 jack from the telephone plugs into device **150**. Power is supplied to device **150** through a plug **162** connected to household electrical wiring.

Module slots **158** are configured to receive modules **80**. Module slots not in use are covered with a plate **160**. Buttons **156** may have predefined functions (in the manner shown in FIG. **9**) or may be soft keys (in the manner shown in FIG. **10**) whose function change in response to what is displayed on screen **152**. One such soft key embodiment can be understood by reviewing the cut out of screen display **136** and buttons **140** in FIG. **10**.

In one embodiment, information displayed on screen **152** is scrolled through using switch **154**.

Slots **158** may have different configurations. In one embodiment, such as is shown in FIG. **11***a,* one slot **158** is a double-height slot capable of receiving, for instance, a speaker phone interface. One could use a form factor similar to Type III PCMCIA to permit the user to insert two single-height modules **80** or one double-height module **80** in a double-wide slot **158**.

An embodiment of a peripheral device circuit which can be used in peripheral device **150** of FIG. **11***a* is shown in FIG. **11***b*. In the circuit of FIG. **11***b,* telephone unit **151** is connected to peripheral device **150** over a standard telephone line.

Telephone unit **151** is a standard POTS telephone. In the embodiment shown, peripheral device **150** includes a processing unit **44**, memory **46**, nonvolatile memory **48** and one or more module slot interfaces **42**. In one such embodiment a display unit **68** is also included to provide feedback to the user. Display unit **68** may be formed as an LED, LCD, video or other such display device. In one embodiment, display unit **68** is an LCD display capable of displaying the current data and time as well as several lines of information. In one such embodiment, CPU **44** drives the LCD directly. In another embodiment, the LCD display includes its own controller and that controller operates under the control of CPU **44**.

In one embodiment, DMTF tones generated by data entry unit **60** in telephone unit **151** are transmitted through line interface **58** to peripheral device **150**. In one such embodiment, data entry unit **60** is a keypad. It should be apparent that a data entry system such as a mouse, pointer or stylus or any other known techniques for data entry in graphical or text environment could be used. In one such embodiment, data entry unit **60** and display unit **68** are combined into a touch screen installed within peripheral device **150**. In another embodiment, soft keys are shown on display unit **68**. In such an embodiment, peripheral device **150** would also include one or more buttons (e.g., buttons **156**) corresponding to the soft keys displayed on display unit **68**.

In one embodiment, a module adding new features to system **10** is connected through a module slot **158** or **160** to a module slot interface **42**. In one such embodiment, processing unit **44** operates in cooperation with module slot interface **42** to read information from a module installed in one of the module slots into memory **46**. In the example shown in FIG. **11***b,* processing unit **44** is connected to module slot interface **42** over mother board bus **62**, module interface **64** and module backplane interface **66**. In one set of embodiments, module backplane interface **66** is a standard interface such as PC/104, USB or PCMCIA. Other methods of connecting the components of circuit **40** will be readily envisioned by one skilled in the art of telecommunications or data processing.

In one embodiment, peripheral device **150** is connected to the central office through a relay **190**. FIG. **11***b* illustrates one such embodiment. In the embodiment shown in FIG. **11***b,* peripheral device **150** can capture the signals being generated by standard telephone unit **151** so that they do no get transmitted to the central office. In one such embodiment relay **190** operates under control of relay driver **191** to break the connection between the central office and telephone unit **151** in certain circumstances. For instance, in one embodiment, peripheral device **150** includes a memo mode used to enter data and display the data on display **68**. In one such embodiment tones generated by touching keypad **60** are not permitted to reach the central office. Instead they are routed to DTMF decoder **192** for capture and subsequent display. This ensures that the central office does not become confused by what appears to be a random set of DTMF tones.

In one relay embodiment, relay **190** is de-energized at initialization When de-energized, relay **190** connects telephone unit **151** through the POTS network to the central office. When, at **700** a user picks up the handset, unit **151** goes off-hook, and telephone unit **151** sounds a dial tone from the central office. The user can then place a call through the central office. If, however, the user wishes to go into a mode supported by peripheral device **150** (e.g., memo mode) he or she presses a button on peripheral device **150**. Relay **190** switches over and isolates unit **151** and device **150** from the central office. (This disconnects units **150** and **151** from the central office. The central office detects on-hook and discontinues the dial tone.). Such an embodiment is shown in FIG. **11***c*.

In FIG. **11***c,* at **700** peripheral device **150** detects off-hook. Processing unit **150** determines at **702** whether a peripheral device feature is being accessed. If so, control moves to **704** and relay **190** is energized in order to disconnect units **150** and **151** from the central office. Control moves to **706** where a power supply **194** under control of CPU **44** begins supplying dial tone to unit **151**. Power to power supply **194** is either supplied through an AC adapter or may be drawn from the POTS line if the current drawn is low enough so as to not appear off-hook to the central office. Processing unit **44** checks at **708** to see whether the phone has been placed back

on-hook. If so, relay **190** is deenergized at **710** and control moves back to the top. If not, control moves to **712** and a check is made to see if one of the services is available. If a service is available, the user can access features of the service at **712**. A check is made at **714** to see whether the service is complete. If so, control moves to **710**.

If, at **702**, unit **44** determines that no peripheral device modes are being accessed, control moves to **716** and DTMF tones generated by the user are captured and store in memory **46**. A check is made at **718** to determine if telephone unit **150** has been placed back on-hook. If so, control moves to **700**.

If, at **718**, unit **151** remains off-hook, control moves to **720** and a check is made to see if a peripheral device mode is being invoked. If so, control moves to **704** and the relay is energized. If not, control moves to **718**.

In one embodiment, a user accesses features on peripheral device **150** by depressing buttons on keypad **60**. The tones are captured and converted to symbols by DMTF decoder **192** and passed to processing unit **44**. From there they are either stored in memory **46** or simply displayed in display **68**. If a user needs to place a call during data entry, relay **190** is turned off and dial tone from power supply **194** is turned off.

In one embodiment, peripheral device **150** continues to monitor DTMF tones while the user is placing the call. In one such embodiment, depressing one of the * or # keys while keeping telephone unit **151** off-hook invokes a service within peripheral device **150**. Peripheral device **150** treats subsequent keystrokes as either commands or data, depending on the application.

CODEC **193** is used to digitize a user's voice for recording messages, etc. It is described in more detail below.

Modules

FIG. **12** illustrates one embodiment of an answering machine/message manager module **110** which can be used in modular telephone system **10**. In the module shown in FIG. **12**, push button interface **92** is connected to five pushbuttons **94** (labeled REC, DEL, FWD, REV and PLAY). In one embodiment, greeting and incoming messages are digitized by CPU **44** and stored on the main board. In a second embodiment, greeting and incoming messages are digitized by the CPU and stored in NVRAM **90** on module **110**. (This approach requires much more storage than the main board storage approach and, as such, it may be easier to justify putting NVRAM on this module. One advantage of local NVRAM is that messages can go with module **110** when it is moved from one system **10** to another). In yet another embodiment, greeting and incoming messages are digitized using an analog to digital converter or CODEC under control of CPU **44**. In another embodiment, this function, and that of CPU **44** is performed in a single digital signal processor or microprocessor device.

In the embodiment shown in FIG. **12**, feedback mechanism **96** is a flashing LED used to indicate that there is a message waiting. Messages are played back through handset **22** or through speaker phone interface **26**, if available.

In the embodiment shown in FIG. **12**, five buttons (labeled REC, DELETE, FWD, REV and PLAY) are used in the user interface. REC is used to record an outgoing message. DELETE is used to delete incoming or outgoing messages from memory. FWD is used to skip the current stored message and point to the next stored message. REV is used to go back to a previous stored message. PLAY retrieves and plays the message. In operation, feedback mechanism **96** (e.g., an LED) is activated when a message is received and is deactivated when the message is played. In one such embodiment, a digital integrated circuit is used to record incoming and outgoing messages.

A custom message entry protocol which can be used with a telephone system **10** having an answering machine/message manager module **110** is described in FIGS. **13***a* and **13***b*. In one embodiment, the custom message is played to incoming callers as a result of detecting the caller ID of the incoming call. In another embodiment, the custom message can also be accessed, if a caller ID module is not installed or the caller ID is not recognized, by the caller entering a security code after a connection is established. Other methods of identifying a caller may be used. In one embodiment, the caller identifier is a sequence of DTMF tones entered after the call has been connected. In another embodiment, the caller identifier uses voice recognition or other biometric identification to identify a caller once the call has been connected. The protocol will be described in the context of caller ID.

In FIGS. **13***a* and **13***b*, a user, at **220**, presses the button **94** labeled REC. A prompt is displayed to the user at **222**. In one embodiment, two buttons, SAVE and CANCEL, are shown as soft keys on display **20**. In such an embodiment, the prompt is displayed on display **20** and takes the form of a message such as "Recording new message. Press SAVE when finished." In another such embodiment, the prompt is displayed more cryptically through one or more visual indicators **104** on module **110**, or through a display element **106** on module **110**. The user can back out at any time by pressing the CANCEL button.

At **224**, the user speaks into handset **22** or microphone **28** to record the new message and touches SAVE to save the message. The message can be "rewound", stopped, played, deleted or recorded again until the user is satisfied.

At **226**, a determination is made, e.g., by CPU **44**, whether a caller ID module is present. If, at **226**, a determination is made that a caller ED module is not present, in one embodiment, the message is saved and message entry is complete. This message then becomes the default message.

In the embodiment shown in FIGS. **13***a* and **13***b*, however, provision is made for entry by the user of a security code to be associated with the recorder message. In one such embodiment, if, at **226**, a determination is made that a caller ID module is not present, control moves to **232** and display **20** displays "Enter security code." The user enters a security code at **234** and saves it using the SAVE button. A test is made at **236** to determine if a security code was entered. If not, control moves to **237** and the message is saved as the default message. If, however, a code was entered, control moves to **238** and the security code and message are saved. The message is then played to the caller whenever that security code is entered.

If, at **226**, a determination is made that a caller ID module is present, control moves to **228** and display **20** displays "Enter caller phone number." Control then moves to **230**, and CPU **44** waits until a number is entered and saved by touching the SAVE button. The number can be edited as necessary. Control then moves to **240**.

In one embodiment, at **240**, a security code is required and steps similar to **232–238** are executed. In another embodiment, as is shown in FIGS. **13***a* and **13***b*, entering a security code is optional at this stage. In one such embodiment, a message like "Security code (optional)" is displayed on display **20** and provision made for the user to enter a security code, if desired. A check is made at **242** to see if the user entered a security code. If so, the security code is saved at **244** and the protocol is finished. A security code

may be attached to a particular caller ID to ensure, for instance, that a voice memo is retrieved by only the person for whom the message is intended.

A voice message service module **120** which can be used with a voice messaging service obtained through the central office is displayed in FIG. **14**. In the module shown in FIG. **14**, push button interface **92** is again connected to five pushbuttons **94** (labeled REC, DEL, FWD, REV and PLAY). Now, however, the buttons work in conjunction with the central office to provide access to messages stored at the central office.

In the embodiment shown in FIG. **14**, feedback mechanism **96** is a flashing LED used to indicate that there is a message waiting. The twisted pair line connecting system **10** to the central office is polled to detect a known special dial tone indicating that a message is waiting to be retrieved. (Usually, the user must be a subscriber of the central office's voice messaging service for this signal to be transmitted to system **10**.) Messages are played back through handset **22** or through speaker phone interface **26**, if available.

In the embodiment shown in FIG. **14**, five buttons (labeled REC, DELETE, FWD, REV and PLAY) are used in the user interface. Their function is similar to the function of the buttons in FIG. **12** above.

In one embodiment, custom messages in module **110** can be reviewed or deleted at any time. One protocol which can be used to review or delete a message is shown in FIG. **15**. In FIG. **15**, at **250**, a list of messages stored in base unit **40** or in module **110** is listed on display **68** with one of the messages highlighted. At **252**, a check is made to determine if one of the buttons on module **110** has been depressed. If not control moves to **250** and the loop is repeated.

If a determination is made at **252** that a button has been depressed, at **254** the appropriate action is performed. In one embodiment, for instance, the user scrolls through the list of messages using the FWD and REV buttons shown in FIG. **12**. Likewise, the highlighted message can be deleted or played by depressing the DEL and PLAY buttons, respectively.

Custom messages can be used to handle a variety of callers. For instance, a custom message can be played to all callers having caller IDs that are blocked, or to callers who provide no caller ID. At the same time, a custom message could be created for the telephones of special people in your life. For instance, a custom message might be appropriate to greet a relative or significant other, or to use as a voice memo for a particular person. Finally, a special message could be entered to answer when that annoying aluminum siding salesman calls during dinner. FIG. **16** illustrates one protocol which can be used to play custom messages in systems having module **110**. In the embodiment shown in FIG. **16**, at **260** custom messaging is enabled. When an incoming call is detected at **262**, control moves to **264** and a determination is made whether a caller ID module is present. If not, control moves to **266** and a determination is made whether an answering machine module **110** is present and enabled.

If no answering machine is available the only use of the custom message is as a voice memo. In that case control moves to **268** and a "chime" or other sound is used to encourage the caller to enter a security code. A check is made at **270** to determine if a security code has been entered. If so, control moves to **272** and a comparison is made of the security code entered against a list of security codes. If no security code is entered, or the security code is not on the list of security codes, the call is terminated. If, however, the security code is on the list of security codes, the custom message associated with the security code is retrieved at **274** and played at **276**.

If, at **266**, it is determined that an answering machine is available, control moves to **278** and a generic greeting is played. In the embodiment shown in FIG. **16**, a user may enter a security code anytime before the generic greeting ends. A check is made at **280** to determine if a security code was entered. If not, control moves to **290** and a check is made whether the generic greeting is done. If so, control moves to **286**. If not, control moves to **280**.

If, however, a determination is made at **280** that a security code has been entered, control moves to **282** and a comparison is made between the security code entered and a list of security codes. If the security code is not on the list of security codes, control moves to **286**, the caller is beeped and control moves to **288** to record the incoming message. In one embodiment, the length of the incoming message is constrained to be the shorter of when the caller hangs up or a predefined period of time (e.g., 45 seconds). The incoming message is digitized and stored either in module **110** or within nonvolatile memory **48**.

If at **264** a determination is made that a caller ID module is, in fact, present, control moves to **292** and the caller ID is captured. A determination is made at **294** to see if the caller ID is blocked. If so, control moves to **266**. If not, however, control moves to **296** and a determination is made whether the caller ID is associated with a custom message. If not, control moves to **266**.

If, however, a determination is made at **296** that the caller ID is associated with a custom message, a check is made at **298** to see if a security code is required before playing the custom message. If not, control moves to **300** and the custom message associated with the caller ID is played. Control then moves to **310**.

If, at **298**, a determination is made that a security code is required before playing the custom message, control moves to **302**. A "chime" or other such sound is played at **302** and a determination is made at **304** whether a security code has been entered. If so, control moves to **306** and a comparison is made between the security code entered and the security code associated with the caller ID received. If the two do not match, control moves **266**.

If, however, the two do match, control moves to **308** and a custom message associated with the caller ID is played. (In one embodiment, each caller ID can have a list of security codes associated with it. In such an embodiment, it is the combination of caller ID and security code which is used to determine the custom message to be played to the caller.) Control then moves to **310**.

At **310**, a determination is made whether answering machine module **110** is present and enabled. If not, the call is terminated. If, however, answering machine module **110** is present and enabled, control moves to **312**, the caller is beeped and control moves to **314** to record the incoming message. In one embodiment, the length of the incoming message is constrained to be the shorter of when the caller hangs up or a predefined period of time (e.g., 45 seconds). The incoming message is digitized and stored either in module **110** or within nonvolatile memory **48**.

In one embodiment, a central office feature manager module **130** is used to extend the functionality of system **10**. Such a module provides simple buttons which correspond to the dialing codes used to control features offered by the telephone company, such as call forwarding. Therefore the user doesn't have to remember the calling codes. One such system is show in FIG. **18**. In the embodiment shown in FIG. **18**, depressing the FWD button causes system **10** to send a code to the central office instructing the central office to forward calls to a different telephone number. In one

embodiment, the telephone number the telephone is forward to is predefined. In another embodiment, depressing the FWD button in module **130** causes CPU **44** to display on display **68** the telephone number to which the telephone forwards by default. The user then uses data entry unit **60** to modify the telephone number or to enter a new telephone number. A message is then displayed on display **68** showing that the telephone is forwarded. In one embodiment, forwarding is canceled, and the central office is notified, by depressing the FWD button again.

In a similar fashion, depressing the CW button invokes call waiting, depressing the 3WAY button invokes three way calling, depressing the REDIAL button causes system **10** to redial the last number dialed and depressing the LAST button causes CPU **44** to display the last caller ID. In one such embodiment, repeatedly depressing LAST causes CPU **44** to scroll back through a list of caller IDs from most recently received to least recently received.

A caller ID module **140** which can be used in system **10** is shown in FIG. **18**. Such a module adds standard caller-ID functionality to telephone system **10**. In the embodiment shown in FIG. **18**, module **140** includes a pushbutton interface **92** which includes a DEL button, a FWD button and a REV button. In one embodiment, nonvolatile memory **90** in module **140** is used to store two or more caller ID entries. The LED is activated when an incoming call is detected and the caller-ID information is displayed on display **68**. The current caller-ID entry displayed in display **68** can be deleted by depressing DEL of module **140**. In addition, the next entry in the list of caller IDs stored in module **140** is displayed when the user depresses the FWD button of module **140**. Similarly, the previous entry in the list of caller IDs stored in module **140** is displayed when the user depresses the REV button of module **140**.

In one embodiment, caller ID module **140** contains enough on-board memory to store up to for instance, one hundred caller ID entries. Each entry must be large enough to store all the information received from the central office specific to the caller ID. In addition, it can be advantageous to attach additional information to each entry at the discretion of the user.

A personal directory module **150** can also be used advantageously in telephone system **10** of FIG. **1**. Personal directory module **150** allows user to maintain a personal phone directory on a system **10**. In one embodiment, directory module **150** captures incoming numbers with the push of a button. In addition, the user can enter numbers manually.

In one embodiment, personal directory module **150** includes a "short-dialing" feature. Short dialing is a user convenience; users can key in just the last 4 digits of number, rather than having to remember all of the digits, and personal directory module **150** will translate the four digit code into a telephone number. Such a feature will be especially important when in the near future, all phone calls will require 10 digit dialing. One embodiment of such a feature is shown in FIG. **25**.

In the embodiment shown in FIG. **25**, at **500** a user in personal directory module mode types in the last four digits of the telephone number that user is attempting to reach. Control moves to **502** and CPU **44** searches the personal directory database for entries which match the four digits entered. If the entry is determined to be unique at **504**, control moves to **506**, the entry is displayed and appropriate DTMF tones are sent to the central office.

If the entry at **504** is not unique, control moves to **508**, and a list of matching entries is displayed in sequence on display **68**. Control then moves to **510**, where the user selects an entry by, for instance, first highlighting that entry and then depressing the ENTER button. The selected entry is displayed at **512** and appropriate DTMF tones are sent to the central office.

One embodiment of a personal directory module **150** is shown in FIG. **19**. In the embodiment shown in FIG. **19**, FIND, EDIT, ENTER/NEW, and DONE buttons provide access to the personal directory features. In addition, in one such embodiment, DELETE, SAVE, HELP, DIAL, UP/DOWN/FWD/REV hard or soft universal front panel buttons are controlled by data entry unit **60** or by a combination of data entry unit **60** and display **68**. In another embodiment, module **150** includes no buttons; all functionality is accessed through soft or hard buttons using data entry unit **60** or by a combination of data entry unit **60** and display **68**.

In one embodiment, the FIND button disables the DTMF from data entry unit **60** and causes CPU **44** to display the personal directory function on display **68**. A user then uses data entry unit **60** (e.g., the numeric telephone keypad) to type in numbers or characters into module **150**. As the characters are entered, they are displayed in display **68**. In one such embodiment, depressing FIND again causes CPU **44** to search the personal directory for matching characters. A list of the closest matches is then displayed on display **68**. In one embodiment, the FIND button causes system **10** to issue a # or * on telephone interface **24**.

In one embodiment, such as is shown in FIG. **19**, module **150** uses NVRAM to store directory data. Such an approach permits the user to remove module **150** from system **10** and carry the module to a different system **10** without losing the underlying directory information.

In one embodiment, the personal directory function displays a list of names and numbers in the personal directory in display **68**. In one embodiment, depressing the EDIT button causes CPU **44** to highlight one of the entries of the personal directory and to display a set of soft keys clustered to the side of display **68**. The soft keys identify editing functions which can be performed in the personal directory entries. In one such embodiment, a DELETE button is used to delete the highlighted entry from memory, an UP button is used to scroll up through the list of entries, a DOWN button is used to scroll down through a list of entries, a SAVE button is used to save the current selected entry into memory **90** and a DIAL button is used to dial the highlighted number.

The ENTER/NEW button prompts the user to enter the new number into module **150** using data entry unit **60** and displays the number on display **68** as it is entered. The DONE button signals that data entry following ENTER/NEW is completed.

In one embodiment, a CALLER ID CAPTURE button either on module **150** or displayed as a soft key on display **68** is used to capture an incoming number to the user's personal directory. Identifying data can then be entered by the user to complete the entry.

In one embodiment, base unit **40** includes a PC or PDA interface (USB, for example) in order to support exchange of personal directory data.

FIG. **20** illustrates one embodiment of a diverter module **160** which can be used in modular telephone system **10**. In one embodiment, diverter module **160** includes a BLOCK button and/or a PLAY button. The PLAY button, when depressed, directs the telephone to play a special message to the caller. Such a feature may be used to play a prerecorded message to, e.g., a persistent and annoying caller. The BLOCK button is used to capture the caller identifier (e.g.,

caller ID or biometric information such as voice recognition) of that persistent caller such that future calls are automatically answered with a prerecorded message. In another embodiment, one or more buttons are provided. Each button is associated with a prerecorded message. The recipient of a call can press one of the buttons and transfer the caller to the prerecorded message. For example, in a two button system, one message may be a pleasant greeting that terminates the call. A second message might be a more aggressive message to an annoying unwanted call.

In one embodiment, diverter module **160** includes a display **106**. Display **106** can be used, e.g., to display the caller ID of the incoming caller. Diverter module **160** can also be used to redirect calls to one or more preset mailboxes or to an internal or external telephone number.

FIG. **21** illustrates a protocol which can be used to divert calls using diverter **160**. As can be seen in FIG. **21**, at **400** a user answers the telephone and determines to "terminate" the call by sending the caller to a prerecorded message. At **402**, the user presses the PLAY button of module **160** and hangs up the telephone. Control moves to **404**, CPU **44** services the PLAY button interrupt request and control moves to **406** where a message associated with the PLAY button is played for the caller. Control moves to **408** and the call is terminated.

In one embodiment, diverter **160** can be used with a second telephone line to forward calls using the second line. In one embodiment, a FWD button on diverter **160** is used to automatically transfer a call to a prerecorded number on the second telephone line. An alternate protocol for accomplishing this is shown in FIGS. **22** and **23**, which illustrate protocols that can be used to divert a call. FIG. **22**, for example, illustrates a method of entering telephone numbers of calls to be diverted. In FIG. **22**, at **410**, the user selects the call diverter function on display **68** and selects "Enter". CPU **44** displays in response, at **412**, a message such as "Enter destination number." At **414**, the user enters the destination number. The number is stored in memory and displayed on display **68**.

A check is made at **416** to determine if a caller identifier module is present. If so, control moves to **418** and CPU **44** displays a message such as "Enter caller telephone number." Control then moves to **420**. If a number is entered at **420**, calls having, for instance, that caller ID are routed to the number entered at **414**. If no number is entered at **420**, the number entered at **414** becomes a default number used for nomnatching caller IDS. Control then moves to **422** and the caller ID (if entered) is stored in memory on diverter **160**.

Likewise, if a determination is made at **416** that no caller identifier module is present, the number entered at **414** is used as the destination of all incoming telephone calls.

In one embodiment, a security code can be associated with each caller identifier. In such an embodiment, system **10** will not forward a telephone call coming from a particular telephone number to the destination associated with its caller ID unless the caller successfully enters a predefined security code. One such embodiment is shown in FIG. **22**. In such an embodiment, control moves from either **416** or **422** to **424**, where CPU **44** displays a message such as "Enter security code." The user can enter a security code or enter a null string. If the user enters, at **426**, a security code in conjunction with a caller identifier, a caller calling from a telephone having that caller identifier will have to enter the appropriate security code before that caller will be forwarded to the destination telephone associated with that caller identifier. Control then moves to **428** and the security code (if entered), the caller identifier (if available) and the diverter telephone number are saved in memory of module **160**.

In operation, system **10** receives a caller ID (or other caller identification) at caller identifier module **140** and saves the identifier to memory. System **10** then accesses the diverter telephone number associated with that caller identifier. If there is no diverter telephone number associated with that caller identifier, the caller is diverted to the default number. If, however there is a diverter telephone number associated with that caller identifier, a check is made to see if a security code is required. If so, the user is prompted for the security code. If the security code and caller identifier are associated with a particular diverter telephone number the caller is forwarded to that number. Otherwise the caller is diverted to the default number.

One such embodiment is shown in FIG. **23**. In FIG. **23**, an incoming call is detected at **440** and control moves to **442** where a determination is made whether a caller identifier module **140** is present. If so, control moves to **444** and a determination is made as to whether the caller identifier is blocked. If not, control moves to **446** and the caller identifier is used to access a diverter telephone number associated with that caller identifier. (If no diverter telephone number is associated with that caller identifier, the default diverter telephone number is used.) Control then moves to **448** and CPU **44** determines if a security code is required for this caller identifier. If not, control moves to **450**, system **10** goes off-hook on the second line and dials the appropriate diverter telephone number. If the telephone is answered on the second line, system **10** goes off-hook on the first line and completes the connection. CPU **44** must then monitor the two lines to detect if one goes on-hook. The call is then terminated.

If, at **448** a determination is made that a security code is required for this caller identifier, system **10** takes the first line off-hook at **452** and sounds a chime or other such sound at **454** to alert the caller to enter a security code. A check is made at **456** to see if a security code is entered and if the code entered was valid for that particular caller identifier. If so, control moves to **450** and the call is completed. Otherwise, the call is terminated.

If, at **442**, no caller identifier module is detected, or if, at **444**, it is discovered that the incoming call has blocked its caller ID, control moves to **460** where a check is made to see if there are any diverter numbers requiring security codes. If not, control moves to **462**, system **10** goes off-hook on the second line and dials the default diverter telephone number. If the telephone is answered on the second line, system **10** goes off-hook on the first line and completes the connection. CPU **44** must then monitor the two lines to detect if one goes on-hook. The call is then terminated.

If, at **460**, a determination is made that at least one diverter number is restricted by security code, control moves to **464** and system **10** takes the first line off-hook. Control then moves to **466** and system **10** sounds a chime or other such sound to alert the caller to enter a security code. A check is made at **468** to see if a security code is entered and at **470** to see if the code entered matches any of the security codes stored in memory. If so, control moves to **472**, the diverter telephone number associated with that security code is retrieved and the call is completed. Otherwise, control moves to **474** and the call is terminated.

A variation on diverter module **160** is shown in FIG. **24**. FIG. **24** shows a three way calling module **170** for use in a system **10** connected to two telephone lines. In one embodiment, module **170** includes a feedback mechanism **96** which indicates the status of each of the two telephone lines. For instance, in one such embodiment, an LED is associated with each telephone line. When the telephone line

is active, the LED is held ON. When the telephone line is inactive the LED is held OFF. When the telephone line is on-hold, the LED flashes.

The embodiment of module **170** shown in FIG. **24** includes LINE1, LINE2, HOLD, MUTE and CONF buttons. Depressing LINE1 while off-hook seizes the first telephone line and lights its associated LED. Depressing LINE2 while off-hook seizes the second telephone line and lights its associated LED. Depressing the HOLD line places the current active line on hold and sets the associated LED to flashing. Depressing MUTE disables the telephone's microphone. Depressing CONF conferences the first and second telephone lines together. If a caller identifier module **140** is present, the numbers associated with the first and second telephone lines are displayed in display **68**. In one embodiment, three way calling module includes only the program code and parameters needed to enable this feature. All the required buttons are displayed as soft keys on display **68** or are accessed through data entry unit **60**.

In one embodiment, system **10** includes an electronic message pad feature which disables the DTMF of a telephone keypad in order to allow the user to enter information via the keypad while talking on the telephone. In one such embodiment, data entry unit **60** includes a telephone keypad and a DTMF DISABLE pushbutton located on the face of system **10** which is used solely to disable DTMF tones from the telephone keypad. If a user wishes to capture numeric information on display **68** by using the telephone keypad, he or she depresses the DTMF DISABLE button on the face of system **10**. In one embodiment, a user wishing to capture numeric information on a telephone keypad presses the DTMF DISABLE button. Depressing the button results in an interrupt to CPU **44**. The interrupt generated by DTMF DISABLE is serviced and a command is sent from CPU **44** to the keypad to disable DTMF generation if any key is pressed. The keypad/ microprocessor interface are designed such that disabling the DTMF generation does not interfere with transmission of data from the keypad to CPU **44**. The user can then enter data and the data entered is displayed on display **68**. It can then be captured and saved to personal directory module **150**, if present. In one embodiment, DTMF generation, once disabled, is re-enabled by depressing DTMF DISABLE again.

In another embodiment, an electronic message pad feature is designed which does not require preventing DTMF tones from reading the central office. Such a feature can be used on-hook to update, for instance, a personal directory module **150**.

Yet another module which can be used in a system such as system **10** is illustrated in FIG. **26**. FIG. **26** illustrates an area code module **180** which can be used to preprogram the numbers for frequently dialed area codes. In the embodiment shown in FIG. **26**, four buttons are provided for module **180**: PROGRAM, CODE **1**, CODE **2**, and CODE **3**. Up to three area codes can be stored and accessed through the buttons CODE **1**, CODE **2**, and CODE **3**. In one embodiment, the PROGRAM button puts module **180** in a "store" mode, permitting capture of digits entered in data entry unit **60**. If the PROGRAM button is pressed in conjunction with the CODE **1** button, the number is entered into memory associated with the CODE **1** button. Similarly, if the PROGRAM button is pressed in conjunction with the CODE **2** or CODE **3** button, the number subsequently entered is stored into memory associated with the CODE **2** or CODE **3** buttons, respectively.

Then when system **10** goes off-hook and one of the code buttons is pressed, the numbers stored in the memory associated with that button are retrieved and DTMF tones representative of those numbers are transmitted to the central office.

It should be apparent that there are other uses for the code buttons of module **180** besides for storing area codes. The code buttons could be used to store PIN numbers or even the security codes required by many of the modules described above. In addition, in one embodiment, one can program a code button with the exchange number of the most commonly used exchange, or with a single telephone number.

The telephone system according to the present invention has a number of advantages. The phone unit is modular, allowing users to tailor phone features to their needs and preferences, providing virtually unlimited upgradability and eliminating clutter by replacing multiple peripherals with an integrated solution. The feature modules are portable. Modules can be used in more than one base unit; the base unit will immediately recognize the functionality and add it to the existing system. The result is a telephone system which can provide a range of features, allowing the user to build capabilities over time.

The modules themselves provide a number of advantageous features. Each module provides a simplified, easily understandable interface, making high-tech features readily available to non-tech users. The user simply plugs in a module to add features like caller-ID and voice messaging. More importantly, complex features normally seen only in sophisticated PBX systems can be added with the same simple approach.

At the same time any of the features described in connection with the modules can be integrated into the base unit of system **10**. Claims to features of telephone system **10** are therefore to be limited only by the language of the claims.

The above approach of adding features to telephones can be used to add features to other electronic devices as well. An electronic system **600** is shown for instance in FIG. **27**. In FIG. **27**, electronic system **600** includes a base unit **601** having a processing unit **602** (e.g., a microcontroller or microprocessor) connected to a memory **604**. In addition, processing unit **602** is connected through a module slot interface **608** to at least one module slot **606**. Module slot **606** is capable of receiving a module **610** having a memory **612**. In one embodiment, memory **604** is nonvolatile memory.

In one embodiment, a module **610** adding new features to base unit **601** is connected through module slot **606** to module slot interface **608**. In one such embodiment, processing unit **602** operates in cooperation with module slot interface **608** to read information from a module **610** installed in one of the module slots **606** into memory **604**.

Module **610** is used to install a new feature in an electronic system. For instance, base unit **601** may be a bread making machine and module **610** may be used to add a new breadmaking process to system **600**. The process may be, for instance, introduction of a pause function used to allow the cook to add additional ingredients. In order to add such a function, module **610** would include (stored in memory **612**) program code **620** for programming processing unit **602** with the new process. In addition, module **610** may include updated application code **622** for updating the basic application (e.g., to correct a bug in the code) and updated parameter information (e.g., new calibration data) for use by electronic system **600**. As in the telephone system described above, this information is downloaded to memory **604** when module **610** is plugged into slot **606**.

Finally, module **610** may include one or more buttons **614** used to indicate to processing unit **602** that a user-controlled

event has occurred (e.g., that all necessary ingredients have been added during the pause period in the breadmaking example given above) and a hot insertion circuit (not shown) to protect module **610** from hot insertion into system **600**. In another embodiment, soft keys may be used in place of buttons **614** where supported within base unit **601**.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiment shown. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

**1**. A modular telephone, comprising:

one or more module slots, including a first module slot, wherein each module slot is configured to receive a module adding a feature to the modular telephone;

a processing unit, wherein the processing unit includes a module slot interface and memory, wherein the module slot interface is connected to each module slot and is adapted to read information from a module installed in the first module slot;

a data entry device; and

a telephone subsystem connected to the processing unit and the data entry device, wherein the telephone module operates in cooperation with the processing unit and the data entry device to provide a feature based on information read from a module installed in the first module slot, wherein the telephone subsystem includes:

a telephone circuit connected to the data entry device;

service connecting means for connecting the telephone circuit to a telephone service;

a receiver; and

a microphone.

**2**. The telephone according to claim **1**, wherein the service connecting means includes a tip and ring interface.

**3**. The telephone according to claim **1**, wherein the first module slot includes circuitry which reads application code stored in a module installed in the first module slot.

**4**. The telephone according to claim **1**, wherein the first module slot includes circuitry which reads operating system code stored in a module installed in the first module slot, wherein the operating system code is used to update operation of the processing unit.

**5**. The telephone according to claim **1**, wherein the memory includes a plurality of distinctive ring locations, wherein each distinctive ring location contains data representative of a distinctive ring signal.

**6**. The modular telephone according to claim **1** wherein the modular telephone further comprises a display screen.

**7**. The modular telephone according to claim **6** wherein the modular telephone further comprises soft keys displayed on the display screen.

**8**. A method of installing a feature in an electronic system, wherein the electronic system includes a processing unit, comprising:

providing a module having memory;

storing information relevant to the feature into the module memory; and

transferring the relevant information to the electronic system, wherein transferring includes reading operating system code from the module memory, wherein the operating system code is used to update operation of the processing unit.

**9**. A method of executing an added feature in an electronic system, wherein the electric system includes a processing unit, comprising:

providing a module having memory and a user interface;

storing information relevant to the feature into the module memory;

tansferring the relevant information to the electronic system; and

accessing the feature, wherein accessing includes entering commands via the user interface.

**10**. The method according to claim **9**, wherein the user interface is a pushbutton and wherein entering commands includes depressing the pushbutton.

**11**. A peripheral device which operates in conjunction with a telephone to add features to the telephone, comprising:

one or more module slots, including a first module slot, wherein each module slot is configured to receive a module adding features to the telephone;

a processing unit, wherein the processing unit includes a module slot interface and memory, wherein the module slot interface is connected to each module slot and is adapted to read information from a module installed in the first module slot; and

a telephone interface which operates in cooperation with the processing unit to provide a feature based on information read from a module installed in the first module slot, wherein the telephone interface includes a relay for disconnecting the telephone from a central office.

**12**. The peripheral device according to claim **11**, wherein the peripheral device receives a modulated signal, digitizes the modulated signal to form an incoming digitized signal and saves the incoming digital signal to memory.

**13**. The peripheral device according to claim **11** wherein the peripheral device reads a message from memory, converts the message to an analog signal and drives the analog signal out through the telephone interface.

**14**. The peripheral device according to claim **11** wherein the peripheral device further comprises a data entry device connected to the processing unit and the telephone subsystem.

**15**. The peripheral device according to claim **14** wherein the data entry device comprises a display screen.

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